CEER Advice on the take-off of a demand response electricity market with smart meters

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INFORMATION PAGE

Abstract

On 10 May 2011, CEER launched a public consultation on CEER Draft Advice on the take-off of a demand response electricity market with smart meters (ref C11-RMF-31-03). That draft advice outlined a number of questions to market actors, in order to provide CEER with input on recommendations that will enhance the implementation of demand response for household customers and small and medium sized businesses. The customer could also be a micro generator, which is reflected in this document.

This document (C11-RMF-36-03) presents our final advice following a workshop, a public consultation and a hearing for public consultation respondents. The Advice is accompanied by an Evaluation of Responses (C11-RMF-36-03a) to the public consultation.

Target Audience

Energy suppliers, traders, micro generators, electricity customers, electricity industry, customer representative groups, network operators, metering operators, Member States, academics and other interested parties.

Related Documents

CEER and ERGEG documents

- CEER Advice on the take-off of a demand response electricity market with smart meters. Evaluation of responses, CEER, December 2011, Ref: C11-RMF-36-03a, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/CUSTOMERS/PC-62%20CEER%20Draft%20advice%20on%20the%20take-off%20of%20a%20demand%20response/CD/C11-RMF-36-03a_DemandResponse-with-SM_EoR.pdf

- GGP on Regulatory Aspects of Smart Metering for Electricity and Gas, ERGEG, February 2011, Ref: E10-RMF-29-05, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Customers/Tab2/E10-RMF-29-05_GGP_SM_8-Feb-2011.pdf

- European Energy Regulators' 2011 Work Programme, CEER, December 2010, Ref. C10-WPDC-20-07, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/C10-WPDC-20-

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- GGP on Indicators for Retail Market Monitoring for Electricity and Gas, ERGEG, October 2010, E10-RMF-27-03 , http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Customers/Tab1/E10-RMF-27-03_final%20GGP%20IRMM_12-Oct-2010.pdf

- GGP on Customer Complaint Handling, Reporting and Classification, ERGEG, June 2010, E10-CEM-33-05, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Guidelines%20of%20Good%20Practice/Other/E10-CEM-33-05_GGP-ComplaintHandling_10-Jun-2010.pdf

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- ERGEG Status Review on Regulatory Aspects of Smart Metering (Electricity and Gas) as of May 2009, ERGEG, October 2009, Ref. E09-RMF-17-03, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Customers/Tab/E09-RMF-17-03_SmartMetering-SR_19-Oct-09.pdf

External documents

- 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,http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF

- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

- Directive on energy end-use efficiency and energy services 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services, http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:114:0064:0064:EN:PDF

- Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF

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interoperability, 12 March 2009, http://www.cen.eu/cen/Sectors/Sectors/Measurement/Documents/M441.pdf

- 2010 Assessment of Demand Response and Advanced Metering, Staff Report, Federal Energy Regulatory Commission, February 2011 (USA), http://www.ferc.gov/legal/staff-reports/2010-dr-report.pdf

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- Opinion 12/2011 on smart metering, Article 29 Data Protection Working Party, April 2011 http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp183_en.pdf

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EXECUTIVE SUMMARY

With this Advice on the take-off of a demand response electricity market with smart meters, CEER aims at enhancing the implementation of demand response with household customers and small and medium sized businesses. We seek to describe the roles and responsibilities for different market actors in order to realise demand response. We also list what we regard as prerequisites to be in place to perform demand response. Customer awareness and participation is key, therefore CEER has chosen to focus on the retail market and its most important actors.

The document can be used as a basic checklist for the take-off of demand response with smart meters. The main target groups for the checklist are the seven market actors we have chosen to pin-point: customers, micro generators, metering operators, DSOs, suppliers, ESCOs and NRAs. Since European countries differ in market design with reference to the roles for DSOs and metering operators, we have chosen to separate the two. This is reflected throughout the recommendations, where we describe the different roles for the two actors. In practice, in many countries these two roles are to be found within one body, the DSO.

CEER recognises that the increase of renewables in the grid and an increase in the level of demand response will require the development of new models for system management. It is likely that a large amount of energy will be used when the price is low. This can cause constraints in the local network. Each regulator has to consider this in relation to the network tariff-regulation and bearing in mind not to create an overly complex electricity market for the customer. CEER sees a number of ways of managing this, among others to offer:

- a flat non-flexible network tariff; or
- capacity-oriented network tariffs, semi flexible, a limited number of predictable tariffs; or
- highly flexible and innovating pricing formulas for network tariffs.

CEER defines demand response as the following:

> *Changes in electric usage by end-use customers/micro generators from their current/normal consumption/injection patterns in response to changes in the price of electricity over time, or to incentive payments designed to adjust electricity usage at times of high wholesale market prices or when system reliability is jeopardised. This change in electricity usage can impact the spot market prices directly as well as over time.*

CEER recognises that there are some key points in the market structure that need to be in place to facilitate the take-off of demand response (in addition to the recommendations outlined in the GGP on smart metering):

- Customers' understanding of information on the electricity market;
- Customers' offered easy ways of becoming aware, through new contracts etc.;
- Customers' trust in the market and thus wanting to participate;
- A non-conflicting grid tariff; and
- The absence of price regulation.

In this Advice, CEER sets out four recommendations, as a basis for the take-off of demand response:

1. **Customer trust:** Service providers should aim to give customers appropriate information on offers, with the goal of creating customer awareness of how changes in lifestyle or occupancy can impact on household consumption patterns and therefore their final electricity bill;
2. **Privacy and security**: When making a decision to install smart metering systems, privacy and security measures have to be guaranteed;
3. **Offers reflecting actual consumption patterns:** Specific roles and prerequisites need to be in place for the market actors to be able to reach full potential of offers reflecting actual consumption patterns (table 1 below);
4. **Interface with the home:** Specific roles and prerequisites need to be in place for the stakeholders to be able to reach full potential of the interface with the home (see table 1 below).

The table below illustrates the specific roles and prerequisites needed to be in place for each market actor in order to be able to reach full potential of offers reflecting actual consumption patterns and interface with the home.

Electricity service →	**Offers reflecting actual consumption patterns**	**Interface with the home**	**Electricity service** ←
Market actors ↓	***Prerequisites***	***Prerequisites***	**Market actors** ↓
Customer The customer is the key actor in order for the full potential of demand response to be realised .	a. Price comparison website; b. Information on consumption and cost; c. Clear and informative bills; d. Access to relevant information on demand; e. Information provided through a choice of at least two communication channels; f. Easy to launch a complaint and solid redress schemes in place.	a. A means to safely and securely access the metering values from the gateway.	**Customer** The customer can use the information available through the gateway to adjust consumption.
Micro generator Contributes by regulating consumption and injection to reflect wholesale prices.	a. Possibility to sell electricity; b. A regulatory scheme to deal with payment/settlement; c. MG should be provided with relevant information on injection data; d. Access to information on price data on demand; e. Information should be provided through a choice of at least two	a. A means to safely and securely access the metering values from the gateway .	**Micro generator** The micro generator can use the information available through the gateway to adjust injection.

	communication channels.		
Metering operator Offers services to provide, install and maintain metering equipment that enables demand response. Responsible for meter reading. Enables smart metering systems capable of recording consumption on a configurable time basis.	a. A minimum set of functionalities. Open communication standards and protocols; b. Open architecture for utility meters involving communication protocols and functionalities enabling interoperability. c. A duty to deliver accurate metering data (necessary for the specified purpose) in a timely manner to relevant market actors.	a. Open standards for the gateway which enable interoperability, so that any market actor, after customer consent, can connect a device to the gateway, without being hindered.	**Metering operator** Responsible for ensuring that the meter is equipped with or connected to an open and secure gateway.
DSO Responsible for the basis of demand response. Enables smart metering systems capable of recording consumption on a configurable time basis.	a. Information on metering values; b. A distribution network system capable of dealing with fluctuation in usage; c. A regulatory scheme on how to deal with payment/settlement for micro generation.	*(Not applicable)*	**DSO** No role in this matter unless the DSO is responsible for metering
Supplier Developing innovating	a. Timely and easy access to information on customers metering values; b. Timely and easy access to	a Standardised and secure gateway.	**Supplier** Develops innovating

pricing formulas that reflect actual consumption.	information on wholesale prices; c. Channels enabling communication on consumption and data between the customer and supplier; d. Capacity to analyse large volume of data quickly; e. A regulatory scheme on how to deal with payment/settlement for micro generation.		pricing formulas, enabled by means of easy access to metering values providing they have the appropriate customer consent
ESCO Offers services to customers and micro generators (home energy management systems etc.).	a. Timely and easy access to information on relevant data according to the offer between the customer/micro generator and the supplier; b. Possibility to aggregate consumption from different customers in a demand response programme.	a. Standardised and secure gateway.	**ESCO** Develops energy management services
NRA Establishes regulatory framework, monitoring measures, develop incentives etc.	a.Establishing network tariff regulation, notably grid tariff structure, compatible with a well functioning demand response market	a. Clearly defined data protection rules applicable for electricity data communication, including the aspect of customer consent.	**NRA** Monitors the electricity market with special regards to customer confidence, privacy and security.

Table 1: Summary of recommendations on Offers reflecting actual consumption patterns (for instance) and Interface with the home. (Tables 2 and 3 below are more extensive in wording.)

1. Introduction

CEER regards customer participation in the electricity market as extremely important, and implementing the possibility of demand response is one way of increasing that participation. CEER has identified demand response as an area that can deliver benefits both to customers and to electricity systems. Customers benefit from an enhanced ability to engage with the electricity market, by managing their consumption and consequently enabling them to manage their costs. In addition, demand response also enables more active participation in electricity markets by micro generators, by creating appropriate incentives to alter their consumption/injection patterns to suit market and system requirements. From a system management perspective demand response has the potential to reduce consumption levels at times of peak demand and also at times when system reliability is jeopardised.

Demand response can change electricity usage over time and reduce usage at peak times. As well as the short-term benefits listed above, this change in usage has the potential to reduce costs over the longer term. This is due to reduced requirements for investment in generation capacity and network infrastructure over the longer term as a result of reduced peak demand. However, building a distribution network system capable of dealing with fluctuations in usage could entail additional investments in the network. CEER recognises that, due to the increased amount of production of renewable energy, it might be necessary to increase investments in a robust local network.

This document seeks to describe the roles and responsibilities for different market actors in order to realise demand response. We also list what we regard as prerequisites that should be in place, to perform demand response. The document can be used as a basic checklist for the take-off of demand response with smart meters in place. The main target groups are the seven market actors we have chosen, who have different roles in demand response: customers, micro generators, metering operators, DSOs, suppliers, ESCOs and NRAs.

When presenting the prerequisites, we realise that in some Member States these are already implemented, in others not, and that - depending on market models - the responsibility for implementing them differs between the countries.

This document relates to a previous ERGEG report: Final Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas (E10-RMF-23-03), hereafter GGP on smart metering. The GGP present 28 recommendations[1]. This advice document further develops two of those, since they are closely linked to the demand response issue: offers reflecting actual consumption patterns and interface with the home.

This task is derived from the following CEER key areas of work (numbering according to the list in the CEER Work programme 2011):
1. 3rd Package implementation
3. Affordability and Consumer issues
4. Climate change, renewable energy issues and energy efficiency

[1] See Annex 6

In order to achieve demand response, the European Commission[2] has outlined a number of key topics, which are addressed in this document and with which CEER agrees. The key topics outlined are: Customer awareness through information; Reflection of wholesale prices; ToU prices, Dynamic Prices and Critical Peak Prices; Automation and innovation; and Regulation.

The aspects captured in this report are primarily information, prices and regulation.

CEER recognises that there are some key points in the market structure that need to be in place to facilitate the take-off of demand response, in addition to the recommendations made in the GGP on smart metering:

- Customers' understanding of information on the electricity market;
- Customers' offered easy ways of becoming aware, through new contracts etc.;
- Customers' trust in the market and thus wanting to participate;
- A non-conflicting grid tariff; and
- The absence of price regulation.

1.1. Background

Intelligent metering systems are promoted for several reasons in the 3rd Package; firstly with the aim to promote energy efficiency and demand-side management measures; and secondly with the aim to ensure active participation of customers in the market. In the definition of "active participation", CEER has chosen to include the possibility for the customer to be also a producer of electricity (micro generator). Furthermore, this is in line with the aim of the 3rd Package to promote the development of smart grids, with one of the goals being an increase of renewable energy sources.

The ERGEG Smart Grids Position Paper[3] lists a high number of functions that smart metering systems can perform, concluding that: smart grids encompass a much wider area of technologies and solutions and are by no means restricted or strictly delimited by the introduction of smart metering. One of the drivers for smart grids from a technical perspective identified in the Position Paper is active participation of customers in the electricity market, with dynamic electricity pricing. It is evident that the absence of smart meters will not guarantee such an active participation that implies, as a minimum, a frequent[4] availability of metering data and a deep awareness of both consumption and injection behaviours that are not possible through electromechanical meters.

CEER believes that an important demand side management measure is demand response. To reach active participation the customers must, in some way or another, be able to react and adjust their consumption or be able to inject electricity. Demand response is the tool for adjusting consumption and injection.

[2] DG ENER presentation at ERGEG workshop on Demand response 11th February 2011, by Manuel Sánchez Jiménez, PhD European Commission, DG ENER Policy Officer, Gas and Electricity

[3] E10-EQS-38-05

[4] More frequent than monthly, preferably hourly, see E10- RMF-23-03, recommendation E6

Innovations in energy services and pricing can contribute to a reduction in consumption and more efficient use of energy across the system and at peak times. Increased knowledge by customers of their consumption and possibly injection will help them to adjust their use of electricity.

The following services outlined in the GGP on smart metering are relevant as the basis for demand response (the letter E stands for Electricity, to separate these recommendations from the ones on gas):

- E 6. Offers reflecting actual consumption patterns
- E 12. Interface with the home

The present Advice adopts a customer perspective and is based on the roll-out of smart meters applied in a de-regulated electricity market.

1.1.1. CEER work process

At a public workshop on 11 February 2011 in Brussels, CEER presented its objective to prepare advice on the take-off of demand response and sought opinions and experiences in this area from market actors as well as organisations and authorities. The workshop was very valuable for CEER when drafting the public consultation document. After the public consultation, we investigated comments from the 45 parties that responded[5] to the consultation.

The 45 parties (one of which was confidential) can be broken down into the following groups:

- 1 response from consumer associations (1 EU);
- 10 responses from energy companies;
- 10 responses from grid operators (2 EU);
- 12 responses from industry associations, (4 EU);
- 5 responses from metering equipment and IT-providers (1 EU);
- 7 responses from research and consultancy firms.

The table below shows the breakdown of the respondents' countries of origin. As can be seen, there were responses from several countries, as well as from European groups. However, there were a couple of countries, namely Germany and the UK, which had a large number of responses.

Respondent Country	Number
Austria	4
EU	8
France	2
Germany	9
Hungary	3
Italy	1
Netherlands	3

[5] See Annex 5 and Evaluation document C11-RMF-36-03a

Spain	2
Sweden	4
Switzerland	1
United Kingdom	8

Table 2: Origin of Respondents

All respondents were also invited to a hearing on 2 September 2011. The hearing proved to be very fruitful and gave CEER good insight into their views and guidance in drafting the final advice.

CEER finds, based on the comments received, that there is a strong interest in applying demand response to household customers, as well as the possibility for customers to become a micro generator. We also find, not surprisingly, that this can be developed in many different ways, suggesting different roles and tasks for different market actors, not least the DSOs. This final advice reflects this, as well as the importance of making thorough investigations before establishing a national point of contact for metering values.

As part of the work process, CEER queried its members to see if there were any existing demand response experiences in place in the countries that have rolled out smart meters. Thirteen countries responded and out of these thirteen countries, three – Italy, Finland and Sweden – have rolled out smart meters. Out of these three, no country has a demand response scheme based on smart metering. CEER also found that several countries have had initial attempts for demand response programmes since many years without smart meters. These programmes are based on regulated approaches directed at the DSOs.

As a result of the work, it has become clear that we need to investigate more the question of a national point of contact, before being able to make any recommendation on that issue. CEER understands that within demand response there is a need to communicate a vast number of metering values to an increasing number of market actors, and a national point of contact could be one efficient solution. However, CEER recognises that this approach has advantages as well as disadvantages. It could probably have benefits in terms of the efficiencies of having one body overseeing the management of all data. It would also enable a united level playing field for the various market actors. However, CEER recognises that there is uncertainty around what is the most secure and cost efficient approach and therefore further investigation is needed before providing a recommendation. Therefore, investigation on national points of contact will be a part of the CEER work programme during 2012. CEER will also during 2012 conduct a benchmarking report on meter data management in a smart metering environment – just to mention two activities in close relation to the recommendations we present here.

1.2. Objective and purpose of this paper

In this Advice, which assumes a customer perspective, the European energy regulators present suggestions on key issues concerning the take-off of demand response. The Advice can be used as a basic checklist for the take-off of demand response with smart meters installed. The main target groups are the seven market actors we have chosen, who have a role in this area: customers, micro generators, metering operators, DSOs, suppliers, ESCOs and NRAs.

Demand response is one of several other parts of demand side management. Demand response can in itself be divided into two parts: direct load control on the one hand, and innovative pricing on the other. The scope of this document is limited to the part described as innovating pricing, since it is here where the customer has an active part.

This document outlines advice for the future, in the sense that active customer participation in demand response through smart metering is not yet a reality. CEER tries to foresee, on an overall basis, the roles and the needs for the market actors that will have the closest connection to the customer.

Within the greater framework of progress on smart metering we focus particularly on the roles for DSOs versus competitive players in terms of customer services offered through smart meters as well as balancing and settlement arrangements that could incentivise suppliers to develop time of use offers to customers.

Where this report refers to customers, they are to be understood as household customers and those customers that are deemed to be covered by Annex I of the 2009 Electricity Directive of the 3rd Package[6]. We also recognise that customers can be micro generators, which is reflected in the roles described below.

[6] 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

2. Demand response

2.1 Definition of demand response

There are various terms and definitions meaning more or less the same thing, when it comes to discussing demand response. CEER would like to emphasise that this document, and thus our definition, does not focus on the network system perspective of demand response – demand side management. CEER's definition of demand response in the context of retail market is:

> *Changes in electric usage by end-use customers/micro generators from their current/normal consumption/injection patterns in response to changes in the price of electricity over time, or to incentive payments designed to adjust electricity usage at times of high wholesale market prices or when system reliability is jeopardised. This change in electricity usage can impact the spot market prices directly as well as over*

Figure 1 below describes the full picture of demand side management, where demand response is a component part. The arrow points at the box which is relevant for the CEER definition above.

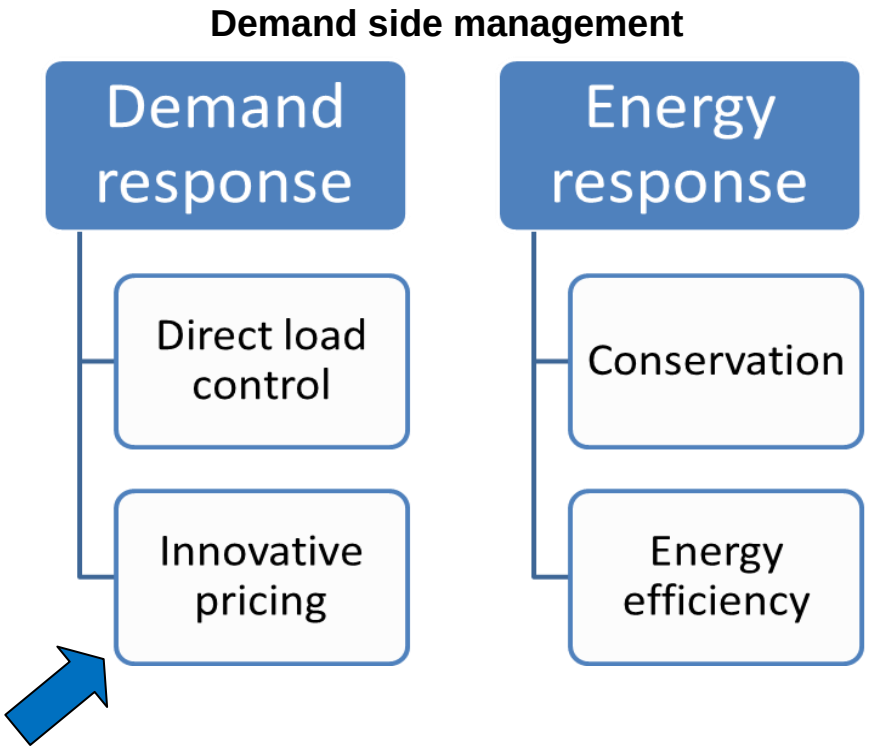

*Figure 1: The picture illustrates **demand side management.** The arrow points at the box relevant for the CEER definition of demand response.*

2.2 Tariff structures

CEER recognises that the increase in renewables in the grid and an increase in the level of demand response will require the development of new models for system management. The daily and hourly profiles of electricity demand at system level differ with respect to the profiles of consumption and power flows in medium voltage distribution networks and of consumption and power flows in low voltage distribution networks. A flat demand profile at system level allows for the reduction in the need for new generation capacity and system services. A flat power flow profile in distribution networks allows for a reduction in the need for distribution capacity and decreases the losses in distribution networks.

As a consequence, different consumer responses are optimal to flatten system demand or to flatten the power flow profiles in distribution networks. Further, power flow profiles vary across local distribution networks. Generally, the consumption patterns, the use of voltage levels and the characteristics of the generation set differ significantly across countries.

These national conditions determine different values for the benefits at system level and at distribution level which can be achieved in each country through demand response measures.

This theoretical scenario is suitable for areas where it is possible to have a flat demand profile. However, in a demand response environment with price signals from the wholesale market affecting the customers' use of electricity, it is likely that a large amount of energy will be used when the price is low. This can cause constraints in the local network. CEER sees a number of ways of managing this, among others to have

- a flat non-flexible network tariff, combined with a well-functioning demand response market with price signals that reflect wholesale prices. This could result in the need for significant investments in the network but increased transparency for the customer; or

- capacity-oriented network tariffs, semi flexible, a limited number of predictable tariffs combined with demand response signals from the wholesale market. This would result in optimisation of the local grid with a possibility to balance network constraints. This alternative means that the customer could have, as an example, a network-tariff based on kW. This alternative would mean that there are a couple of different grid tariffs but not too many as to make it extremely complex for the customer; or

- highly flexible and innovating pricing formulas for network tariffs combined with demand response with price signals from the wholesale market. This would result in optimising of the local grid meaning a minimum of network constraints but a possible result is conflicting price signals from the wholesale market. This could increase complexity and confusion for the active customer and for other actors on the competitive market if not properly addressed.

CEER recognises that each NRA has to consider this in relation to network tariff-regulation in order to fulfil a well-functioning demand response. However, it is very important to note that pricing, for example time-of-use pricing, is part of the decisions made in the competitive market and should reflect the access to - and need for - energy at any given time. For the suppliers to be able to give customers offers that reflect actual consumption patterns, DSOs/metering operators have to enable smart metering systems capable of recording consumption on a configurable time basis.

CEER finds that for the reasons stated above the DSOs' role with regards to demand response should be restricted to the basic requirements necessary to facilitate demand response

2.3 Home automation

Demand response can be performed in many ways, with different roles for the metering equipment. As regards home automation, the meter can be part of the communication system, although demand response can also be managed without the meter when applying home automation. It can be done through applications in the actual appliance communicating via internet. This might be an option for customers that have not yet been fitted with a smart meter.

As regards the information retrieved trough the gateway (interface in the home), it can be used for designing energy services with a certain degree of automation. It is clear that the customer cannot be instantly active all the time, but on the basis of offers designed to react to price signals and installed automation, he/she can adapt consumption.

2.4 Market actors

There are many different market actors, both old and new, that might take part in the future demand side energy world: DSOs, TSOs, metering operators, producers, traders, balancing responsible parties, suppliers, energy service companies (ESCOs), aggregators, electric power grid equipment vendors, ancillary service providers, information and communication technology (ICT) service providers, grid communications network providers, home appliance vendors, Building Energy Management Systems (BEMS), electric transportation/vehicle solutions providers and clearing and settlement agents. Other actors on the electricity market are customers, micro generators, regulators, standardisation bodies, EU, national legislation authorities and financial sector undertakings.

CEER has chosen the following seven actors as the most relevant when discussing demand response at the retail level: customers, micro generators, DSOs, metering operators, suppliers, ESCOs and NRAs. CEER recognises that differences in market design may affect the roles and responsibilities of the different actors.

Since European countries differ in market design concerning the roles for DSOs and metering operators, we have chosen to separate the two. This is reflected throughout the recommendations, where we describe the different roles for the two actors. In practice in many countries, these two roles are to be found within one body, the DSO.

Furthermore, the role of the TSO is important when considering the system perspectives. In this document, however, we have chosen not to focus separately on the TSOs since the primary focus is the customer perspective and the direct contacts the customer needs to have.

As regards the DSO, it is also important to note that due to different market designs there is a variety in the number of DSOs in the Member States. In a country with many DSOs, it is naturally very important that there should not appear many different grid tariffs for the suppliers to take into account when creating offers to customers. That would probably hamper the development of demand response as regards the possibility to choose from a variety of offers as well as the general transparency of the market conditions. In a country with a few or only one DSO, this will not cause the same problem.

It is important that demand response is applied as far as feasible, and that possible network constraints will not pose unexpected consequences for the customers. The actor called aggregator could possibly be a key mediator once capacity markets on the low voltage level are established in Europe. This mediation can be performed by new actors but also, of course, within an already existing body like a supplier or an ESCO. The role of the aggregator needs to be further examined along with the development of capacity markets.

Finally, CEER would like to emphasise that the descriptions of the market actor roles´ described in the recommendations are not exhaustive explanations of the roles. All the actors have a variety of important tasks that are not covered here.

3 Recommendations

The four CEER recommendations on demand response are divided under the following subjects:

1. Customer trust
2. Privacy and security
3. Offers reflecting actual consumption patterns
4. Interface with the home

3.1 Customer trust

CEER recognises that in an increasingly complex market with more market actors to deal with than before and new offers to consider there is an increased need for the customer to be and feel secure and trust the market and its participants. This is particularly true for vulnerable customers. The information on new offers must be presented in a clear and correct manner. Also, there should be a solid complaint handling system as well as redress schemes in place. An important actor with regard to information will be the single point of contact for questions on electricity and gas, as required by the 3rd Package[7].

Regarding customer information on complaint handling standards, a website is a very useful tool but cannot be considered sufficient to inform all customers, and in particular the most vulnerable ones. Therefore, it seems relevant to provide a document on complaint handling standards in printed form if a customer requests it. CEER does not intend to make any recommendations in this area at this point.

Customer protection from, for example, unfair selling methods, regret periods etc. must be considered when making an overview of the regulatory framework when implementing demand response nationally. The demand response environment, with a varying amount of possible offerings, might be experienced as complicated. One crucial factor is the way the customer is informed. The customer should be informed not only about the demand response possibilities but also of the potential impact related to other circumstances that can affect the electricity bill. One example is that seasonal conditions can cause big changes in the electricity price. Another example is that a demand response scheme with high prices during the day and low in the night combined with a change in household occupancy patterns can have great effects on your electricity bill. The information presented on the bill should be clear and informative in order to enhance customer trust and awareness when participating in demand response schemes.

Recommendation 1: Service providers should aim to give customers appropriate information on offers[8], with the goal of creating customer awareness of how changes in lifestyle or occupancy can impact on household consumption patterns and therefore their final electricity bill.

[7] 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

[8] This information can be communicated through different channels, e.g. projected bills.

3.2 Privacy and Security

It is important to note that already today all market actors, with or without connection to a data hub, are responsible for privacy and security for the data they handle. CEER recognises that privacy and security aspects are always important to take into consideration especially in demand response.

CEER has previously stated that the customer should be in control of his/her consumption data.[9] Full transparency on existing customer data should be the general principle. For instance, when a service provider is in charge of information on the customer's power capacity (kW) the customer should in this case be able to a) know that this data exists, and b) receive information on the explicit data. It is always the customer that chooses in which way metering data shall be used and by whom, with the exception of metering data required to fulfil regulated duties within the national market model. This consent in disseminating data can be withdrawn should the customer so choose.

With more frequent metering readings and thus more granulated data being stored and transmitted between market actors, the issue of data security will become even more important than before.

Recommendation 2: When making a decision to install smart metering systems, privacy and security have to be guaranteed.

3.3 Offers reflecting actual consumption patterns

Member States or, where a Member State has so provided, the NRA, shall strongly recommend that electricity undertakings optimise the use of electricity, developing innovative pricing formulas which reflect actual consumption[10]. It is essential that the supplier be able to make offers to the customer (and those that both generate and consume electricity) that better reflect actual consumption/injection divided into different time periods. Offers could take the form of dynamic pricing, time of use (ToU) tariffs and critical peak pricing for example:

- Dynamic pricing is defined as an offer that would reflect for instance hourly consumption and that would mean that the price of the offer would reflect wholesale-prices at any given time;
- A ToU tariff is where the price of electricity varies at different times of the day to reflect the changes in the costs of producing electricity, for example the Irish Smart Metering pilot[11] trialled four specific time of use tariffs offering different unit prices for the night time, day time and peak times.

[9] GGP Smart Metering

[10] 3rd Package

[11] Electricity Smart Metering Customer Behaviour Trial (CBT) Findings Report (CER 11/080a), Commission for Energy Regulation (Irish NRA), May 2011.

Residential Tariffs

Domestic Time of Use Tariff				
		Night 23.00 – 08.00	**Day** 08.00 – 17.00 19.00 – 23.00 weekdays 17.00-19.00 weekends and bank holidays	**Peak** 17.00 – 19.00 (Monday to Friday), excluding bank holidays
Tariff A	Cents per kWh	12.00	14.00	20.00
Tariff B	Cents per kWh	11.00	13.50	26.00
Tariff C	Cents per kWh	10.00	13.00	32.00
Tariff D	Cents per kWh	9.00	12.50	38.00

Table 3: Residential Time-of-Use tariffs 1 January to 31 December 2010;
Source: Electricity Smart Metering Customer Behaviour Trials Findings Report CER/11/080a (table 2)

- Critical Peak Pricing (CPP) is the pricing regime applied by suppliers during specific periods of high electricity demand (e.g. higher electricity prices on hot summer afternoons, encouraging customers to reduce usage during critical-peak periods, in order to avoid high bills). For example, in California, Southern California Edison's (SCE) Critical Peak Pricing offers benefits to customers for shifting or reducing electricity use during critical peak events in the summer season. Under SCE's Critical Peak Pricing, a CPP event may be called (between 9 and 15 times per summer) when local demand for energy significantly increases. During CPP events, energy charges increase significantly so, by reducing electricity usage during a CPP event, customers can avoid these higher prices and benefit from lower electricity bills. CPP events are limited in number and duration, and are activated (or "called") for limited essential reasons[12]

CEER finds that the DSOs' role with regards to offers reflecting actual consumption should be restricted to the basic requirements. Should the DSO be responsible for incentivising demand response, this would have to be through innovative network tariffs. This would lead to a number of consequences, including customer confusion, difficulties in setting network tariffs and increased complexity for NRAs and reduced transparency. We also see an increased complexity in network tariffs for suppliers and ESCOs, which creates difficulties in formulating tariffs reflecting actual consumption; particularly in Member States with multiple DSOs. Last but not least, the customer has no power in negotiating network tariffs – it is important to minimise the extent of the areas in the electricity market where the customer has limited possibilities to act.

CEER acknowledges that there is likely to be an increased diversity in the range of tariff offers. This poses new challenges for customers' possibility to make price comparisons.

Prerequisites mentioned in the table below under Micro generator are to be regarded as an addition to those prerequisites stated under Customer (since the micro generator is considered as a customer who decided to produce electricity).

CEER realises that the success of demand response depends on the willingness and ability for the customer to participate. However, it should be up to the customer to choose the level of activity and not imposed upon him/her.

[12] http://www.sce.com/b-rs/large-business/cpp/critical-peak-pricing.htm

Recommendation 3: Specific roles and prerequisites need to be in place for the market actors to be able to reach full potential of offers reflecting actual consumption patterns. See table below.

The table below illustrates market actors' roles and prerequisites in relation to *Offers reflecting actual consumption patterns,* i.e. time-sensitive energy prices (for instance Time of Use, dynamic or critical peak pricing)*:*

Electricity service →	**Offers reflecting actual consumption patterns**
Market actor role ↓	***Prerequisites***
Customer The customer is the key actor in order for the full potential of demand response to be realised.	a. Access to a reliable price comparison website. b. Receive information on consumption and cost at least monthly, free of charge, in a clear and concise manner. c. Have access to relevant information on consumption and cost data on customer demand. d. Receive information provided through a choice of at least two communication channels, for example an in home display, website, SMS, via smartphones. The level of detail and frequency of access to information depends on the offer the customer has chosen. e. Ability to easily launch a complaint and solid redress schemes in place.
Micro generator Contributes by regulating consumption and injection to reflect wholesale prices	a. Have the possibility to sell electricity. b. Have a regulatory scheme to deal with payment/settlement. c. MG should be provided with relevant information on injection data according to the contract at least monthly, free of charge, in a clear and concise manner. d. Have access to information on price data on demand. e. Information should be provided through a choice of at least two communication channels, for example an in home display, website, SMS, via smartphones.
Metering operator Offers services to provide, install and maintain metering equipment that enables demand response.	a. Have a minimum set of functionalities (two way communication, hourly metering or three registers, remote reading, remote power capacity reduction/increase, software to be upgraded remotely). b. Have open communication standards and

Responsible for meter reading. Enables smart metering systems capable of recording consumption on a configurable time basis.	protocols. c. Have open architecture for utility meters involving communication protocols and functionalities enabling interoperability. d. Have a duty to deliver accurate metering data (necessary for the specified purpose) in a timely manner to relevant actors, e.g. balancing data to the DSO.
DSO The neutral market facilitator, responsible for the basis of demand response. Enables smart metering systems capable of recording consumption on a configurable time basis.	a. Have information on metering values regarding consumption and injection. b. Have a distribution network system capable of dealing with fluctuation in usage resulting from demand response. c. Have a regulatory scheme on how to deal with payment/settlement for micro generation.
Supplier Develops innovative pricing formulas that reflect actual consumption.	a. Have timely and easy access to information on customers metering values regarding consumption and injection. b. Have timely and easy access to information on wholesale prices. c. Have channels enabling communication on consumption and data between customer and supplier. d. Have the capacity to analyse large volume of data quickly. e. Being able to use a regulatory scheme on how to deal with payment/settlement for micro generation.
ESCO Offers services and products to customers and micro generators (in home displays, software applications, home energy management systems, energy storage devices etc.).	a. Have timely and easy access to information on relevant data according to the offer between customer/micro generator and supplier. b. Have the possibility to aggregate consumption from different customers in a demand response programme.
NRA Establishes necessary regulatory framework, monitoring measures, develops incentives etc.	a. Establishes network tariff regulation, notably grid tariff structure, compatible with a well-functioning demand response market

3.4 Interface with the home; Access to metering-data

In order to access metering-data CEER recommended that the meter should be equipped with or connected to an open gateway[13]. The customer and service provider/s (suppliers, energy service companies, etc.) chosen by the customer should be able to have access to relevant data through this gateway. This approach would not give the DSO a privileged position compared to other service providers. The gateway should be a standardised interface which would enable energy management solutions, such as home automation, different schemes on demand response and facilitate delivery of data directly, etc. For example, the gateway should allow for the installation of an in home display that could be offered by the market, e.g. ESCOs, suppliers, hardware stores. It is the very gateway, for example a USB portal, from which metering data can be retrieved. The access to the consumption data allows the customer to have direct insight into consumption patterns.

Recommendation 4: **Specific roles and prerequisites need to be in place for the stakeholders to be able to reach full potential of the Interface with the home**. See table below.

The table below illustrates market actor roles and prerequisites in relation to *Interface with the home*:

Electricity service →	**Offers reflecting actual consumption patterns**
Market actor role ↓	
Customer The customer can use the information available through the gateway to adjust consumption.	Have a means to safely and securely access the metering values from the gateway.
Micro generator The micro generator can use the information available through the gateway to adjust injection.	Have a means to safely and securely access the metering values from the gateway.
Metering operator The metering operator is responsible for ensuring that the meter is equipped with or	Being able to use open standards for the gateway which enable interoperability, so that any market actor, after customer consent, can connect a device to the gateway, without being hindered.

[13] Interface with the home

connected to an open and secure gateway.	
Supplier Develops innovating pricing formulas, enabled by means of easy access to metering values provided they have the appropriate customer consent	Have a standardised and secure gateway.
ESCO Develops energy management services, by means of easy access to relevant metering values, provided they have the appropriate customer consent.	Have a standardised and secure gateway.
NRA Monitors the electricity market with special regards to customer confidence, privacy and security.	Having set clearly defined rules applicable for electricity data communication, including rules regarding customer consent in line with data protection legislation.

Table 4: Recommendation on Interface with the home.

4 Conclusions

To reach demand response, the customer is the key actor. As we see it, the customer shall also be encouraged to act as micro generator. To achieve awareness and then action is not always easy. This puts a great responsibility on all other stakeholders to develop well-functioning markets with attractive offers where the customer realises that he or she has something to gain from demand response, and that participation is feasible both as far as information is concerned and as regards to economic issues. Demand response has to be understandable for customers and participation should be as easy as possible.

As for the take-off of demand response, CEER presents the following four recommendations:

1.	**Customer trust**	Service providers should aim to give customers appropriate information on offers[14], with the goal of creating customer awareness of how changes in lifestyle or occupancy can impact on household consumption patterns and therefore their final electricity bill.
2.	**Privacy and Security**	When making a decision to install smart metering systems, privacy and security measures have to be guaranteed.
3.	**Offers reflecting actual consumption patterns**	Roles and prerequisites for key market actors with regards to offers reflecting actual consumption patterns. *(See table 2 for details)*
4.	**Interface with the home**	Roles and prerequisites for key market actors with regards to interface with the home. *(See table 3 for details)*

Table 5: Overview over the four recommendations.

[14] This information can be communicated through different channels, e.g. projected bills.

Annex 1 – CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national regulators of electricity and gas at EU and international level. Through CEER, a not-for-profit association, the national regulators cooperate and exchange best practice. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable EU internal energy market that works in the public interest.

CEER works closely with, and supports, the Agency for the Cooperation of Energy Regulators (ACER).

ACER, which has its seat in Ljubljana, is an EU Agency with its own staff and resources. CEER, based in Brussels, deals with many complementary (and not overlapping) issues to ACER's work such as international issues, smart grids, sustainability and customer issues.

The work of CEER is structured according to a number of working groups and task forces, composed of staff members of the national energy regulatory authorities, and supported by the CEER Secretariat.

This report was prepared by the Retail Market Functioning Task Force of the Retail Markets and Customer Working Group.

Annex 2 – List of abbreviations

Term	Definition
BEMS	Building Energy Management Systems
CEER	Council of European Energy Regulators
CEN	Comité Européen de Normalisation
CENELEC	Comité Européen de Normalisation Électrotechnique.
DG	Directorate General (of the European Commission)
DG ENER	Directorate General for Energy
DSO	Distribution System Operator
ERGEG	European Regulators Group for Electricity and Gas
ESCO	Energy Service Company
ETSI	European Telecommunications Standards
GGP	Guidelines of Good Practice
ICT	Information and communication technologies
M/441	Mandate M/441
NRA	National Regulatory Authority
RMF TF	Retail Market Functioning Task Force
TSO	Transmission System Operator
ToU	Time of Use

Table 6: List of Abbreviations

Annex 3 – Glossary of Terms and definitions of Market actors

Terms

The description of terms listed here serve to provide a common understanding of the different subjects and apply in the first instance to the issues addressed in this document. Beyond that, for any other issue of general importance or of common understanding, the definitions in the existing legal framework, including the 3rd Package and Regulation (EC) 1228/2003, apply. Some differences with definitions already in use in other situations and/or specifications might be possible.

Interoperability: The ability of a system or a product to work well with other systems or products.

Metering values through web portal/gateway: Transformation of metering data into web format can be presented through different channels. Capability of the metering system to inform on total usage, injection and other metrological and non-metrological data for external visual display.

Remote reading: Metering value read remotely and stored, with provision to relevant service providers. The meter values are registered through a standard interface at a predefined time schedule or upon request. This includes export metering (i.e provision of consumption and injection data and exported net flows).

Standards: Voluntary technical specifications and common technical rules for products or systems to be placed on the market.

Time of Use registers: Capability of a meter to record consumption and injection into separate totaliser registers, additional to the single incremental totaliser register, according to time bands (e.g: 3 separate totaliser registers are needed if there are 3 time bands: peak, off-peak, midlevel; 2 separate totaliser registers are needed if there are 2 time bands: day, night). This capability allows time of use pricing but is not suitable for handling real-time pricing and critical peak pricing.

Two-way communication: The meter has the capability of two-way communication between the metering system and the relevant service providers. The metering system has the capability to retrieve data at a distance on e.g. usage, network and supply quality, events, network or meter status and non-metrological data and to make this data available to the relevant service providers. It gives the ability to the relevant service providers to configure the metering system at a distance, and to carry out firmware/software upgrades. It is also possible for the metering system to receive information – for example information sent from the supplier (and/or via relevant third parties e.g. DSO or metering operator) to the customers' smart meter.

Interval metering: Capability of meter to record consumption and injection at short intervals (e.g. 10 or 15 minutes, 1 hour and so on) and store them for a minimum period (e.g.: 1 month) inside the meter before being read by the data collector. These capabilities require the transmission to the data collector of a significant amount of values (e.g. for active energy consumed: 2,880 values for 1 month of 30 days if the interval is 15 minutes). It allows time of use pricing and is suitable for handling real-time pricing and critical peak pricing.

Meter reading of injected: Meter capable of registering both injected and consumed energy.

Remote management: Remote management means enablement and disablement (control and configuration) of total supply and flow/power limitation through configurable parameters set at the meter. This is managed by the relevant service provider. Where applicable, it also means the possibility of direct control of sub-meters in the home. Remote management offers the capability of the metering system to securely exchange data with home and building or energy management systems.

Definitions of market actors

Aggregator: A key mediator between the consumers/producers, markets and other power system participants in a competitive electricity market. It offers services to aggregate energy production from different sources (generators) and acts towards the grid as one entity, including local aggregation of demand (Demand Response management) and supply (generation management). In cases where the aggregator is not a supplier, it maintains a contract with the supplier

Ancillary Services providers: providers of such services as those services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system[15].

Balance Responsible Party: Ensures that the supply of electricity corresponds to the anticipated consumption of electricity during a given time period and financially regulates for any imbalance that arises.

Clearing & Settlement agent: Assumes liability for clearing and/or settlement of contracts and provides contractual counterparty within a Power Exchange and for Over the Counter (OTC) contracts.

Customer: Where this report refers to customers they are to be understood as household customers and those customers that are deemed to be encompassed by Annex I of the 2009 Electricity Directive when implementing the 3rd Package.

Electric Power Grid Equipment vendors: stakeholder that sells electric equipment that support the functioning of the power grid.

[15] FERC 1995

Metering operator: the entity which offers services to provide, install and maintain metering equipment related to a supply. In most EU Member States the DSO is also metering operator. In case of a specific contractual basis, the contract is mostly with the network operator, or may be with the customer or the supplier. The meter may be rented to, or exceptionally owned by, the customer.

Power Exchange: Provides a market place for trading physical and financial (capacity/energy and derivates) contracts for capacity allocation by implicit auctions within the defined country, region or cross border.

Regulator: Independent body responsible for the definition of framework (market rules), for setting up of system charges (tariffs), monitoring of the functioning and performance of energy markets and undertaking any necessary measures to ensure effective and efficient market, non-discriminative treatment of all actors and transparency and involvement of all affected stakeholders.

Standardisation bodies: Responsible for standardisation of all relevant elements and components within the electricity supply chain, which in turn leads to harmonisation of relevant services, support towards removing barriers to trade, creating new market opportunities and reducing manufacturing costs.

Supplier: Has a contractual agreement with end customer relating to the supply of electricity**.**

Trader: A person or entity that buys and sells energy goods and services in an organised electricity market (Power Exchange) or Over the Counter.

Annex 4 – Existing, early kinds of demand response

Demand side management is nothing new. Today, we have a de-regulated electricity market, which affects the processes in a broader perspective (not only the system perspective) and gives the customers as well as other market actors new opportunities. As a customer you have the possibility to save money, use energy in a flexible way and contribute to a more sustainable society.

Different kinds of demand response schemes have existed for many years, but have focused on the system perspective using methods such as load shedding. In France typically, there is the existence of critical peak pricing. That is to say that on days when electricity demand reaches its peak, the so called peak days, these typical customers pay their energy more expensively than the base load customer or the peak/off peak option customer. In return, the rest of the year, electricity is charged at a rate close to the price of peak hours of EDF Bleu Ciel. For these customers, electricity is overcharged 22 days per year, from November to March. EDF chooses these days depending on the anticipated demand for electricity and prevents its customers the day before. For households and small industrial customers, this tariff was proposed by EDF until 1998. Today, only customers who have subscribed before 1998 can benefit from it (today representing around 5,9 TWh of the consumption). For medium and large industrial customers, this offer is still offered (representing 8,7 TWh of the consumption).

Annex 5 – Respondents of the public consultation

	Organisation	Abbreviated name	Country of Origin
	Respondent Group – Consumer Associations		
1	The European Consumers' Organisation	BEUC	EU
	Respondent Group – Energy Companies		
2	British Gas Trading Ltd	BRGAS	UK
3	EDF	EDF	FR
5	EDF Energy	EDF En	UK
6	Edison S.p.a.	Edison	IT
7	EnBW Energie Baden-Württemberg AG	ENBW	DE
8	Stadtwerke München GmbH	SWM	DE
9	VERBUND AG	Verbund	AT
10	MVKE		HU
11	Oberoende Elhandlare (Federation of Independent Electricity Traders in Sweden)	OBERO	SE
12	Energie Versorgung Niederösterreich	EVN	AT
	Respondent Group – Grid Operators		
13	Netbeheer nederland(Liander/Enexis/Stedin/Cogas)	ALLIANDER	NL
14	EDF DÉMÁSZ Halozat	EDF DÉMÁSZ	HU
15	E.ON AG	E.ON	DE
16	E.ON Hungária- DSO companies	E.ON	HU
17	BEWAG NETZ GmbH	BWAG	AT
18	Göteborg Energi Nät AB		SE
19	Électricité Réseau Distribution France	ERDF	FR
20	European DSO Association for Smart Grids	EDSO-SG	EU
21	Groupement Européen des Entreprises et Organisations de Distribution d'Ènergie	GEODE	EU
22	RWE Deutschland AG	RWE	DE
23	Red Eléctrica de España	REE	ES
	Respondent Group – Industry Associations		
24	Bundesverband der Energie- und Wasserwirtschaft e.V**. -** German Association of Energy and Water Industries	BDEW	DE
25	Bundesverband Neuer Energieanbieter e.V. - Federal Association of New Energy Suppliers	BNE	DE
26	EXELON Limited	ELEXL	UK
27	Asociación de Comercializadores Independientes de Energía	ACIE	ES
28	General Electric	GE	EU
29	EURELECTRIC	EURELECTRIC	EU
30	European Federation of Local Energy Companies	CEDEC	EU

31	Österreichs Energie- Weirtschaft	OESTW	AT
32	Svensk Energi – Swed Energy		SE
33	Verband kommunaler Unternehmen - German Association of Local Utilities	VKU	DE
34	Smart Energy Demand Coalition	SEDC	EU
35	Thuega AG		DE
	Respondent Group – IT Providers		
36	Echelon Corporation	ECHEL	UK
37	eMeter	eMeter	UK
38	European Smart Metering Industry Group	ESMIG	EU
39	Landis+Gyr AG	Landis+Gyr	CH
40	PANASONIC EUROPE	PANASONIC	DE
	Respondent Group – Research and Consultancy Firms		
41	Electricity Efficiency	ELEFF	UK
42	Utility Partnership Ltd		UK
43	Vereniging Energie-Nederland		NL
44	Rdaboud University	RU	NL
45	Sustainability First		UK
46	Wireless Maingate		SE

Annex 6 – Recommendations from the GGP on Regulatory Aspects of Smart Metering for Electricity and Gas

Electricity and gas:
E/G 1. Customer control of metering data

Electricity
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
E 14. When making a cost benefit analysis, an extensive value chain should be used
E 15. All customers should benefit from smart metering
E 16. No discrimination when rolling out smart meters

Gas
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
G 14. When making a cost benefit analysis, an extensive value chain should be used
G 15. All customers should benefit from smart metering
G 16. No discrimination when rolling out smart meters