Position Paper on Smart Grids

An ERGEG Conclusions Paper

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INFORMATION PAGE

Abstract

On 17 December 2009, ERGEG launched a public consultation on its Position Paper on Smart Grids, E09-EQS-30-04.

The present document (E10-EQS-38-05) is ERGEG's Conclusions Paper to this public consultation on Smart Grids, which includes a list of the respondents and an evaluation of the responses received.

NOTE: This updated version includes a corrigendum which suppresses an editorial error in ERGEG's definition of smart grids, section 2.1.2.

Target Audience

Consumer representative groups, network users, policy-makers, electricity industry, distribution system operators, transmission system operators, electric and electronic equipment manufacturers, standardisation organisations, energy suppliers, energy services providers, information and communication technology providers, academics, researchers and other interested parties.

Treatment of Responses

All responses (no material received was marked as confidential) are published on the website www.energy-regulators.eu .

Related Documents

[1] European Technology Platform SmartGrids, "Strategic Deployment Document for Europe's Electricity Networks of the Future", Final Report, 20 April 2010. Online available: http://www.smartgrids.eu/

[2] Regulation (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) Nº 1228/2003. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0015:0035:EN:PDF

[3] CEER, Council of European Energy Regulators (Task Force on Quality of Electricity Supply), "4th Benchmarking Report on Quality of Electricity Supply 2008", December 2008. http://www.energy-regulators.eu/

[4] Commission of the European Communities, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions “Investing in the Development of Low Carbon Technologies (SET-Plan)”, COM(2009) 519 final, Brussels, 7 October 2009.

A list of additional references is available in Annex 4 “References” of the ERGEG Public Consultation Paper E09-EQS-30-04.

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EXECUTIVE SUMMARY

Conclusions Paper on Smart Grids - Intelligent Electricity Networks of the Future

ERGEG launched its "Position Paper on Smart Grids" for public consultation on 17 December 2009. The purpose of the consultation was to assist regulators in understanding how smart grids can benefit network users and, potentially, other stakeholders in the European electricity supply system. It was also designed to explore ways in which the development of smart grids can be encouraged, where cost effective. The Consultation Paper explored the drivers and opportunities for 'smarter' networks and discussed the regulatory challenges and priorities. It proposed a number of key questions and issues for stakeholders to respond to.

The context for ERGEG's consideration of smart grids is set by the key energy objectives of the European Union for the year 2020 – increasing renewable energy supply to 20% of total demand, reducing energy consumption by 20% with respect to 2020 forecasts and reducing greenhouse gas emissions by 20% with respect to 1990 levels – and the more ambitious objectives currently being developed for 2050. The most significant contribution that the electricity supply sector will make to reducing greenhouse gas emissions will be by replacing fossil-fired generation with low or zero carbon generation technologies. Nevertheless, the other key components of the supply chain, networks and the demand side, will also have vital roles to play. Smarter networks are expected to be a key facilitator in the transition to a low-carbon energy sector.

The consultation has generated significant interest amongst stakeholders. 104 people attended the consultation workshop held in Brussels on 17 March 2010 and 50 written responses have been received. All of the responses have been considered by ERGEG and a summary of them has been produced (Annex 3 of this Conclusions Paper). The responses offered a high level of support for the positions set out by ERGEG in the Consultation Paper although alternative views were expressed on a number of issues. A concise summary is provided here.

Network challenges and smarter grids

The responses demonstrated an almost unanimous consensus that network companies are facing significant challenges in effectively playing their part in the low-carbon transition. While there is not yet a single view of what a smart grid is, there was strong support for ERGEG's definition and the principles behind it; user-centric and focused on outputs. There was also strong support for ERGEG's understanding of the drivers for smart grids, although a number of additional drivers were proposed. It is also accepted that the challenges will be different for transmission and distribution with the potential planning and operational changes being more significant for distribution networks. The need to introduce smart grid solutions will depend strongly on local system characteristics, in particular the current and future generation mix. There were many comments on the relationship between smart meters and smart grids with some arguing that smart metering is an essential component of a smart grid.

While there would appear to be benefit in establishing a single, widely-accepted definition of a smart grid there does not appear to be much prospect of achieving this at this time. ERGEG has

therefore concluded that it will retain its definition without change as it is technology neutral and user-centric. ERGEG remains of the view that a smart grid encompasses a very wide scope of technologies and solutions that are not restricted by or necessarily conditional on the introduction of smart metering.

Opportunities and challenges

The majority of respondents supported ERGEG's user-centric approach to the consideration of smarter grid opportunities. Some qualified this support by arguing that the scope of benefits should be broader than those directly related to the electricity supply system. It was also argued that network companies would only be beneficiaries of the development of a smarter grid if the regulatory framework provided appropriate rewards for the level of investment and the risks involved. This framework must also encourage other stakeholders to engage positively.

Respondents agreed that it would be essential for energy suppliers and energy service companies to be actively engaged in the deployment of smarter grid solutions, particularly as they will increasingly involve customers directly. There must be clarity about the roles and responsibilities of stakeholders and common standards for the way they interact on a number of levels.

There was wide agreement that ERGEG has identified the most important current and future network user needs together with the related challenges and solutions. The transition to a smarter grid will take place in an evolutionary way and there must be the flexibility to take account of the need for new services over time. The allocation of costs should be transparent. Attention should be paid to the added complexity of managing the quality of supply recognising that this may not need to be enhanced for all networks. Extant solutions may continue to offer best value in the future and the problems of gaining consent to extend the network when necessary should not be under-estimated.

Most respondents considered that the adoption of smart grid solutions will offer better value for money for network users in the longer term than many existing design and operating strategies. Regulators should therefore adopt policies that encourage innovation for the benefit of current and future network users and maintain a stable financial environment for network companies.

Priorities for regulation

The three main priorities identified by respondents were: to focus on the outputs of network companies; to encourage co-operation amongst stakeholders so that the main barriers are addressed; and to encourage innovation while protecting consumers' interests. ERGEG agrees that while high level principles can be applied across Member States, detailed implementation will vary from country to country.

There is broad agreement that smarter grids are a means to an end, not an end in themselves. This is consistent with ERGEG's preference for a focus on outputs. However, it is noted that some input regulation will continue to be required, for example through grid codes by ENTSO-E and the relevant framework guidelines and grid code approvals by ERGEG and later on by the

Agency[1], and that the technical as well as economic dimensions of regulatory policy should be considered.

The benefits and performance measures related to smarter grids that were identified in the consultation document were supported but additions were proposed that ERGEG agrees with. The 'spin-off' benefits (e.g. smart grid industrial business opportunity) were highlighted although ERGEG considers that it would be difficult for regulators to properly recognise these under their existing mandates.

While there is wide support for regulators to encourage innovation, it is acknowledged that output measures are probably not the most effective way of doing this. For example, demonstration projects will have very different success criteria than 'business as usual' activities. It is also considered important to ensure that learning from innovation projects, particularly those funded or incentivised by network tariffs and other public funds at European and national level, must be widely disseminated between network companies, regulators and others. One area where there was disagreement was in relation to the need for more standards for smart grids. Opposing views were expressed by different parties.

Finally, the need to build capacity in the workforce to deliver smarter grids was highlighted and ERGEG agrees that this should be factored in to policy development.

Recommendations and next steps

ERGEG has found this consultation to be of real value. It has met the objectives of assisting the regulators in understanding how smart grids can benefit all stakeholders in the European electricity supply system and exploring ways of encouraging the cost effective development of smart grids. The responses received have broadly supported the positions set out in the Consultation Paper. As a result of this consultation, ERGEG makes the following recommendations:

R-1: to ensure, as appropriate, a long-term stable regulatory framework and reasonable rate of return for cost-efficient grid investments;

R-2: to consider and further analyse decoupling between grid operators' profits and volumes of electricity they deliver taking into account the introduction of performance indicators and performance-based incentive regulation;

R-3: to pursue regulation of outputs as a mechanism to ensure value for money paid by network users and to investigate metrics for the quantification of the most important output effects and benefits at national level;

R-4: to promote mechanisms favouring an improved awareness of consumers about their electricity use and market opportunities through actions of suppliers and other market participants and an improved engagement of network operators with their network users;

[1] The Agency for the Cooperation of Energy Regulators (ACER), established by Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators

R-5: to encourage the deployment of smart grid solutions, where they are a cost-efficient alternative for existing solutions, and as a first step in this direction, to find ways of incentivising network companies to pursue innovative solutions where this can be considered beneficial from the viewpoint of society;

R-6: to evaluate the breakdown of costs and benefits of possible demonstration projects for each network stakeholder and to take decisions or give advice to decision-makers based on societal cost-benefit assessment which take into account costs and benefits for each stakeholder and for society as a whole;

R-7: to ensure dissemination of the results and lessons learned from the demonstration projects in case they are (co-)financed by additional grid tariffs or from public funds to all interested parties, including other network operators, market participants, etc.;

R-8: to participate in 'smart grids' discussions and cooperation activities among stakeholders and especially to consider an active cooperation with European and national standardisation organisations, grid operators and manufacturers, for example on open protocols and standards for information management and data exchange, in order to achieve interoperability of smart grid devices and systems;

R-9: to clarify the difference between regulated grid activities and market opportunities for new services under a competitive regime (e.g. aggregation of resources, EV recharging) and to carefully monitor the possible presence of cross subsidies between network activities by TSOs or DSOs and market-based activities;

R-10: to continue their exchange of expertise at European level, in order to learn as soon as possible from best regulatory practices.

The conclusions and recommendations drawn from this experience will be important for ERGEG to effectively advise the European Commission in developing the future European policy framework for smart grids, as envisaged in the ongoing Task Force[2] for the implementation of smart grids in the internal energy market. In addition to this and the other aforementioned active participation of CEER/ERGEG in several "smart grid" initiatives at European level, ERGEG is evaluating the opportunity for:

- analysing new elements of market design, business models and marketplaces which are expected to arise together with the future deployment of smart grids;

- carrying out a benchmarking activity at EU level to i) identify the current status of deployment of "smart" technologies across European grids and ii) select and quantify a few promising performance indicators and grid output measures.

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

1 Introduction

1.1 Objective and purpose of this paper

On 17 December 2009, ERGEG launched a public consultation on its Position Paper on Smart Grids, (Ref. E09-EQS-30-04 - briefly recapped in Section 1.2). The consultation period ended on 1 March 2010. 50 responses were received to this consultation document. A list of the respondents (Section 1.3) and an evaluation of responses (Annex 3) is appended to this document. Further, a workshop was organised by ERGEG on 17 March 2010 in order to discuss with all interested stakeholders (see Section 1.4) the preliminary views outlined in the Consultation Paper[3].

The objective of this Conclusions Paper is to evaluate the responses received by the stakeholders and to state the final views and recommendations of ERGEG after the consultation process.

1.2 Recap of ERGEG public consultation

The ERGEG Consultation Paper on Smart Grids aimed to initiate a dialogue with all stakeholders of the European electricity power systems and markets, in order to assist regulators in understanding how smart grids can benefit network users and, assuming that cost-effective benefits can be identified, to explore ways in which the development of smart grids can be encouraged.

The Consultation Paper explored the drivers and opportunities for 'smarter' networks from the users' perspective. It discussed the regulatory challenges and priorities and proposed a number of questions and issues for stakeholders to respond to.

1.2.1 Definitions and understandings of smart grids and their drivers

Among many definitions of sometimes different smart grid concepts, ERGEG's understanding on smart grids is based upon the needs for them, i.e. what they are intended to solve, and what kind of functions and output values they can provide to users of transmission and distribution (T&D) grids. ERGEG relates smart grids to a future T&D grid that is needed for reaching efficiently the EU targets for the year 2020, with a much larger scope than smart metering.

The Consultation Paper identified two main drivers for the development of smart grids: European legislation for carbon reduction and energy efficiency, as a macro driver transposed in national legislation and policies to meet the environmental targets that the Member States have committed to deliver. The second set of drivers is the specific needs of network users that will

[3] Throughout this paper, the term "Consultation Paper" refers to the ERGEG Consultation Paper on Smart Grids, ref. E09-EQS-30-04, December 2009.

result from this legislation, referring to i) large-scale renewable energy sources, ii) distributed generation, iii) end-user participation[4], iv) market integration and v) improved operational security.

1.2.2 Smart grid opportunities and regulatory challenges

Regulators act as surrogate consumers and therefore approach the potential of smart grids from the perspective of the benefit they can bring to consumers and all network users – a user-centric approach. ERGEG observed in the Consultation Paper that the fundamental services that network users (generators, consumers and those that both generate and consume electricity) will need in the future are not radically different from those they require today, e.g. for consumers: a competitive price, fair connection fees, a quality of supply comparable to previous levels and no shortages or price spikes. New network services will be required particularly by new types of generation, including efficient connection, suitable access products, participation in ancillary services markets, enhanced balancing services and intra-day trade.

It is expected that the level of system monitoring and control that is already a feature of transmission systems will migrate down to lower voltage systems. More sophisticated power electronic technologies and direct current devices could be more commonly deployed. More information on network assets can help to improve network utilisation. Improved automation in distribution grids could allow the optimal use of grid reconfiguration after faults. These are just a few examples of smart solutions that are expected to be deployed.

1.2.3 Priorities for regulation

A first priority for regulators is to concentrate on outputs of the regulated entity. Regulation of outputs can be done by direct regulation, i.e. minimum requirements for certain parameters, and/or by performance-based incentive regulation providing penalties and rewards related to certain criteria and performance indicators. A regulatory scheme for promoting improvements in performance of electricity networks requires the quantification, through appropriate indicators, of the effects and benefits of “smartness”. The Consultation Paper proposed seven effects and benefits of “smartness” and a list of potential performance indicators.

A second priority for regulators should be to have an active role in favouring cooperation among stakeholders, to achieve national and European targets by the various smart grid concepts, innovations and solutions. The role for regulators is to facilitate ‘smart grids’ discussions, definition of common views, and cooperation among all stakeholders. Such cooperation should be especially devoted to agreeing which smart grid concepts will provide clear and greater net benefits (i.e. the benefits minus any possible additional costs) to network users and to the whole society, to identifying the possible presence of regulatory barriers to such smart grid concepts and to finding the best solutions to remove them.

[4] For the sake of clarity, the term “end-user” from the Consultation Paper, is in this paper replaced by “consumer”.

A third priority for regulators is to find ways of encouraging an adequate level and scope of more radical innovations while providing an appropriate degree of protection of consumer interests and economically-effective development of the network. Regulators will critically assess the incentivisation of less innovative network companies to invest in innovative solutions to the benefit of consumers. This challenge could be one of the characteristics of a monopoly business like electricity grid operation, where instead of competition or a technology "revolution" (which are the major forces driving innovation in market businesses), additional regulatory support is needed.

Regulators should further support the increasing efforts and international cooperation in research and development (R&D) in the field of electricity grids and smart solutions and promote their efficiency and effectiveness. Regulators, acting as observers in such activities, should favour an approach targeted to define performance indicators for specific smart solutions, and later identify their costs and benefits to network users. Regulators should also support the link between R&D projects and demonstration and initial deployment of selected promising solutions. Supporting the transition process from R&D to demonstration and finally to full deployment of smart solutions, when it is profitable from the point of view of the whole society, while incentivising only economically and technologically efficient grid technologies, should also be one of the future tasks for the national regulatory authorities. The participation of regulators in this process could reduce the risk of having duplication of costs and financial burden for the consumers.

1.3 Responses received

ERGEG received 50 responses to its consultation. The following tables list the respondents by category (in alphabetical order: consumer associations; energy companies; grid operators or their associations; industry associations covering various sectors in the electricity supply chain; renewable energy producers or associations; research or consulting organisations; service providers or manufacturers).

Type	Respondent	Short description	No.	Country
Consumer assoc.	Altroconsumo	Italian consumer association	02	Italy
Consumer assoc.	Consumer Focus	Independent champion for consumers across England, Scotland, Wales	08	United Kingdom
Consumer assoc.	VZBV Verbraucherzentrale Bundesverband e.V.	Federation of German Consumer Organisations	47	Germany

Table 1: List of respondents: consumer associations

Type	Respondent	No.	Country[5]
Energy company	BNE Bundesverband Neuer Energieanbieter (Federal Association of New Energy Suppliers)	04	Germany
Energy company	Centrica plc	07	United Kingdom
Energy company	DONG Energy A/S	10	Denmark
Energy company	EDF Energy	12	United Kingdom
Energy company	EDF	13	France
Energy company	Edison Spa	14	Italy
Energy company	EnBW Energie Baden - Württemberg AG	20	Germany
Energy company	E.ON AG	24	Germany
Energy company	SSE Scottish and Southern Energy plc	40	United Kingdom

Table 2: List of respondents: energy companies

Type	Respondent	Short description	No.	Country
Grid operator	EDP distribuçao	Distribution operator	15	Portugal
Grid operator	EEGI-DSOs	Group of DSOs participating in EEGI	16	International
Grid operator	ENA - Energy networks association	Association of TSO and DSOs	19	United Kingdom
Grid operator	ENERGINET.DK	Transmission operator	21	Denmark
Grid operator	ENTSO-E	Association of TSOs	23	International
Grid operator	ERDF Électricité Réseau Distribution France	Distribution operator	25	France
Grid operator	GEODE	Association of DSOs	30	International
Grid operator	National Grid	Transmission operator	34	United Kingdom
Grid operator	Netbeheer Nederland	Association of DSOs	35	The Netherlands
Grid operator	RWE Rheinland Westfalen Netz	Distribution operator	36	Germany
Grid operator	Swissgrid	Transmission operator	42	Switzerland
Grid operator	Synergrid (only on behalf of DSOs)	Belgian Federation of electricity and gas network operators	43	Belgium

Table 3: List of respondents: grid operators and their associations

[5] The “main” country is mentioned for international companies.

Type	Respondent	Short description	No.	Country
Industry assoc.	BDEW Bundesverband der Energie und Wasserwirtschaft	German Association of Energy and Water Industries	03	Germany
Industry assoc.	CEDEC	European federation of local public energy distribution companies	06	International
Industry assoc.	EFET	European federation energy traders	17	International
Industry assoc.	FutuRed	Spanish electrical grid platform	29	Spain
Industry assoc.	Svensk Energi	Electricity industry association	41	Sweden
Industry assoc.	EPSU	European Federation of Public Service Unions	49	International
Industry assoc.	Eurelectric	Union of the Electricity Industry - Eurelectric	50	International

Table 4: List of respondents: industry associations

Type	Respondent	No.	Country
Renewable	EGEC European geothermal energy council	18	International
Renewable	EWEA European wind energy association	28	International
Renewable	Joint declaration World Future Council and other associations of renewable energy organisations	31	International

Table 5: List of respondents: renewable energy producers and associations

Type	Respondent	No.	Country
Research/cons.	BNEF, Bloomberg new energy finance	05	United Kingdom
Research/cons.	DERlab network of Excellence under FP6 (group of experts)	09	International
Research/cons.	Frans Nieuwenhout, ECN, coordinator IEE-Altener project IMPROGRES	11	The Netherlands
Research/cons.	Even Consults	27	Belgium
Research/cons.	KTH - Royal Institute of Technology and Power Circle	32	Sweden
Research/cons.	VDE-ETG, German Power Engineering Society	46	Germany

Table 6: List of respondents: research or consulting organisations

Type	Respondent	No.	Country
Service provider	Accenture	01	International
Service provider	EnerNOC UK Limited	22	United Kingdom
Service provider	ESMIG European Smart Metering Industry Group, association of Smart Metering market players	26	International
Service provider	Landys+Gyr Ltd.	33	International
Service provider	SAGEM Communications SAS	37	France
Service provider	Schneider Electric	38	International
Service provider	Silver Spring Networks	39	USA/Australia
Service provider	T&D Europe, European association of electricity T&D equipment and service industry	44	International
Service provider	Teradata	45	International
Service provider	ZVEI e.V., association of German electrical and electronic manufacturers	48	Germany

Table 7: List of respondents: service providers and manufacturers

Grouping of respondents by category and by country is presented in Figure 1.

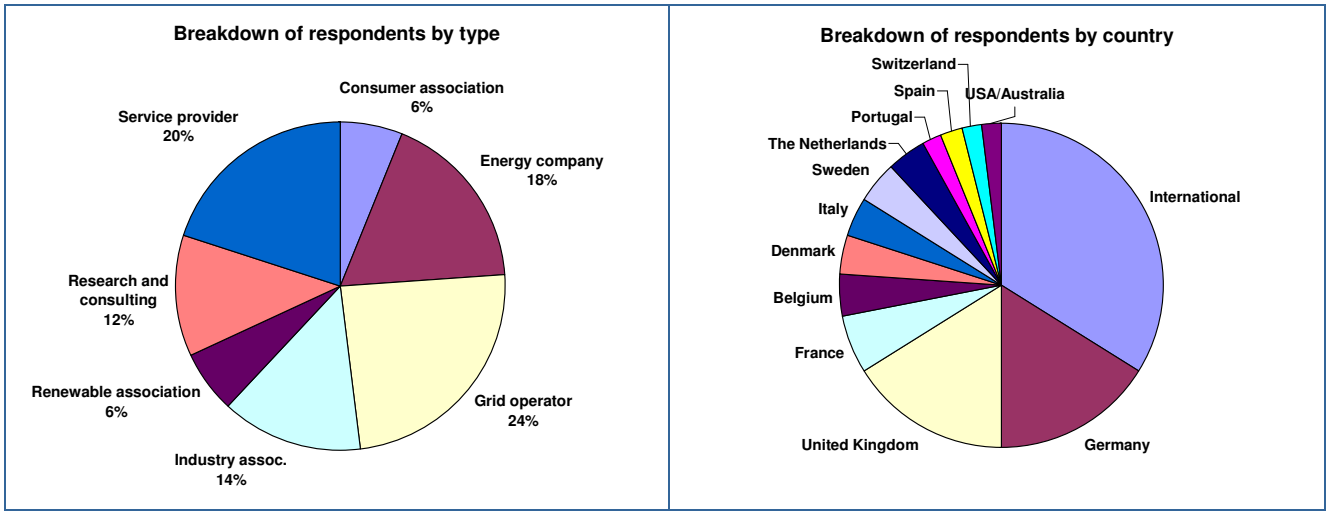

Figure 1: Breakdown of respondents by type (left) and by country (right)

1.3.1 ERGEG's views on the balance of responses

There was a large participation by grid operators, by service providers and manufacturers, by energy companies and by the associations of these three groups. But only a few responses were received from some network users (consumers and renewable producers and their associations). Further, some of the responses provided few general messages, lacking a deeper analysis of concepts and preliminary views discussed in the Consultation Paper.

ERGEG is pleased with the large participation to the public consultation on smart grids and thanks all respondents. Due to the reasons explained above, ERGEG does not consider that the responses represent a totally sound balance among the whole structure of the EU electricity market. Further, this is a signal of the need for an improved awareness of network users of the opportunities and future benefits which can be delivered by smarter grids, as further highlighted in this Conclusions Paper.

1.4 ERGEG Workshop on Smart Grids (17 March 2010)

The Smart Grids Workshop organised by ERGEG on 17 March 2010 provided the opportunity to present the Consultation Paper to stakeholders and to have information and feedback from the organisations, including among others the European Commission (DG Energy and DG Research), ENTSO-E, Eurelectric, BEUC and CENELEC, in addition to receiving the written feedback from the public consultation. This section summarises the main outcomes of the workshop, which do not necessarily correspond to ERGEG's opinion.

Smart grids will mean three big changes for the electricity sector. Firstly, electricity generation will change as there will be co-existence of central and decentralised generation. Secondly, smart grids will change the way electricity is traded as they will significantly affect consumer behaviour. And thirdly, smart grids will integrate network users into the electricity system. The reasons for not having large-scale deployment of smart grids relate to limited pilot experiences and uncertainties regarding the investment needs and new market models. As a result, network operators responsible for investments require support from legislators and regulators. There is clearly a need to develop European policy and regulatory directions to drive forward the development of smart grids. For this purpose, the European Commission has established a Smart Grids Task Force with an assignment to deliver a mission, vision and a roadmap for smart grids in Europe by May 2011.

A critical challenge for the EU is to reduce the current 80% dependency on fossil fuels to 80% reduction in greenhouse gas emissions in 40 years. This requires a reinvention of the energy system. We need to move to a low-carbon economy but that is not easy, cheap or swift. Technology and the efficient use of the resources are essential for this transition. The Strategic Energy Technology Plan (SET Plan), adopted in November 2007, is the technology pillar of the EU's energy and climate change policy. The objective is to accelerate the development of low-carbon technologies leading to their market take-up.

In order to promote technology development and to accelerate innovation to support energy-climate objectives, the European Commission has established industry-led public-private partnerships, the European Industrial Initiatives, one of which is the European Electricity Grid Initiative (EEGI). The objective of EEGI is to demonstrate and quantify the value of smart grids solutions before large scale deployment. The role of regulators in the EEGI process is to provide inputs to the scope and contents of the EEGI and, as appropriate, to the Smart Grids Task Force. What is needed is that regulatory regimes that incentivise network operators' involvement in research, development and demonstration (R&D&D) are defined in line with the 3rd Package. There is also a need for providing incentives for a coordinated approach and knowledge sharing

in TSO or DSO led R&D&D projects. For fast progress, dissemination of the demonstration project results is important.

Three issues were identified as crucial for success in reaching the targets by 2020. To invest in smart grids, network operators need money but also a stable regulatory framework and a positive operation environment. Furthermore, skills are important too. The electricity utilities are well-informed but consumer awareness is needed to succeed in the full utilisation of the smart grids. Consumers and all network users should be more in the focus. This could be incentivised e.g. by introducing user satisfaction as one indicator for network operators' performance in the area of smart grids. Additionally, the business environment affects the investment decisions and in this respect the roles of various actors need to be clarified and settled.

The workshop also recognised the importance of standardisation for the full and efficient utilisation of smart grids. Stakeholder discussions have already been organised and standardisation is also addressed in the Commission Smart Grids Task Force and its Expert Groups as well as in the relevant standardisation organisations and their stakeholder groups.

2 Consideration of responses

This chapter contains ERGEG's comments and conclusions on the views expressed by the respondents to each of the 18 questions posed in Section 1.3 of the Consultation Paper. The sections within this chapter aim to provide an ERGEG conclusion taking account of the ERGEG positions that were submitted for public consultation. For more details, please refer to the annexes, or the complete respondents' replies available through www.energy-regulators.eu.

2.1 The definition and understanding of smart grids and their drivers

2.1.1 Future network challenges

The Consultation Paper expressed the view that there will be a paradigm shift in the way that electricity networks will be planned, operated and maintained to meet the environmental challenges of 2020 and beyond. The responses demonstrated very wide support for the view that transmission and distribution networks are facing significant challenges that will require innovative solutions in the near future. A number of respondents commented that the challenges were greater for distribution networks than for transmission networks.

Many parties made the point that these challenges extend beyond the traditional network boundaries and that in future the development of the power system will need to be approached in a more holistic way; in particular, consumers would need to become active elements of the overall system. Non-technical challenges were also raised including market design and the finance-ability of the network companies. A number of respondents argued that regulators should put incentives in place to encourage innovation.

ERGEG broadly agrees with the comments made. While this Conclusions Paper focuses on network issues, ERGEG agrees that consideration must be given to the wider issues highlighted by respondents in developing network regulatory mechanisms (e.g. contribution of network activities to the development of new markets). It is also accepted that the challenges are greater for distribution networks than transmission. On balance, ERGEG considers that network innovation incentives could be beneficial in helping address the challenges identified but understands that the need for such incentives will vary between Member States depending particularly on other national funding mechanisms.

2.1.2 ERGEG's smart grid definition

In the Consultation Paper, ERGEG set out its user-centric and output-focused definition on smart grids, developed based on the definition from the European Technology Platform SmartGrids [1]:

Smart Grid is an electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it – generators, consumers and those that do both – in order to ensure

economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety.

There has been much debate about the definition of a smart grid ever since the term was first coined. Many parties have published definitions; some focusing on the technologies that might be deployed in a smart grid and others on the services that a smart grid can offer to its users. ERGEG has chosen the latter approach for its definition (developed based on [1]) on the basis that it represents the users of networks. Most respondents have broadly agreed with ERGEG's definition but many have suggested variations. There does not appear to be a common theme to these suggestions. Some have argued for an extension of the scope of the definition, one respondent thought it should be more precise.

ERGEG has given consideration to all of the comments made. While there would appear to be benefit in establishing a single, widely accepted definition, there does not seem to be much prospect of achieving this at this time. ERGEG has therefore concluded that it will retain its definition without change as it is technology neutral and user-centric. ERGEG does agree that the use of the term "smart grid" can imply that current grids are not smart. This is clearly not true, particularly at higher voltage levels, where, according to one respondent, "*one can reasonably state the electricity transmission system has been evolving into smart grids for decades*". ERGEG therefore agrees that it is more helpful to talk about "smarter" grids as already done in the Consultation Paper. It is expected that people's understanding of the smart grid concepts will develop with time.

2.1.3 The relationship between Smart Grids and Smart Metering

The Consultation Paper commented on the relationship between smart grids and smart metering. In particular, it stated that it is possible to have a smarter network without smart metering. This issue was raised because there was concern that many parties were confusing smart meters and smart grids. This resulted in a number of comments from respondents. In particular, some respondents expressed the view that smart meters are fundamental to delivering a smarter grid.

ERGEG remains of the view that it is technically possible to develop smart grid and smart meter infrastructures independently of each other. It is important to explain this to promote a better understanding of the two concepts. However, ERGEG is not proposing this as a way forward, in fact quite the contrary. It is important to make use of any possible synergies between smart metering and smart grids where both are being deployed.

ERGEG does recognise that the rate of deployment of smart meters is likely to be different to smart grids and that the challenge for network companies and, in some countries, meter owners/operators, is to find the most effective ways of linking the two programmes. However, ERGEG emphasises that smart metering concerns only some of future smart grid functionalities. As stated in the consultation document, "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."

2.1.4 The relationship between volume and profit

The question as to whether the objective of reducing energy consumption imposes the need for decoupling network operators' profits from the volume of energy seems not always to have been fully understood. The reason that ERGEG included this question was a concern that profits proportionally related to the volume of energy delivered might discourage grid operators from implementing measures for energy efficiency.

Most respondents think that partial decoupling of the network operators' profits from the volume of energy delivered is a good idea. However, some parties point out that volume is a cost driver and that this should be reflected in the tariffs. Other parties argue that decoupling in itself is not sufficient and that this should be combined with additional measures to promote energy efficiency.

Some respondents point out that energy efficiency will not necessarily lead to a reduction in electricity consumption and that perhaps volumes of electricity should rise (due to its use for e.g. transportation and heating) to meet the 20/20/20 objectives. Other respondents doubt if the network operators should be made responsible for reducing energy demand.

We summarise by stating that from ERGEG's point of view, decoupling of profits from volumes of energy delivered is envisaged. Please note that a decoupling between grid operators' profits and electrical energy volumes is different from decoupling between revenues and volumes, which takes into account that volume is a cost driver.

2.1.5 Smart grid - the drivers

In general, there is agreement among the respondents about the drivers for smart grids as identified in the Consultation Paper. However, some additional drivers are suggested.

An important driver, which was only briefly mentioned in the Consultation Paper, seems to be the change in load, both in volume and timing. Examples of such changes in load are the increasing use of electricity for transportation (e.g. electrical vehicles) and heating (e.g. heat pumps). ERGEG considers that the change in load can indeed be considered as a driver, if (1) there is a step change in the load over time (in contrast with a steady increase of the use of the network), or if (2) there is a changing load in time and space (due to e.g. electrical vehicles). In both cases, it can become necessary to introduce some form of supply-side or demand-side management.

Other additional drivers mentioned are 'technology-push' (as e.g. developments in ICT or storage), subsidies and the ageing of the grid. However, ERGEG sees these developments as enablers for smart grids, not as drivers. Developments in ICT for example will not in themselves change the operations of a grid if there is nothing to drive the operator to implement new ICT. The same argument holds for the ageing of grids: there is a need to replace assets, but an additional driver is needed to make the grid smarter.

2.2 Smart grid opportunities and regulatory challenges

2.2.1 User-centric approach

Most respondents agree more or less with the user-centric approach of the Consultation Paper, but for some it includes an even wider circle of involved parties (e.g. system/equipment manufacturers, technology vendors and even taxpayers). They understand the development of smart grids as induced by political requirements, so, real benefits should be realised to generate value to the consumer/citizen. With a systemic and global approach, the real interest of smart grids is a welfare interest. It is therefore necessary to evaluate which costs can be socialised. Costs should be distributed equitably amongst stakeholders, remuneration of grid companies should fairly reflect the cost and risk and go beyond simply looking at users' needs, considering the wider societal benefits.

An economically-efficient energy system solely from the perspective of energy suppliers is difficult to implement. Sufficient drivers can only be produced with a vision of the energy market place. For one DSO, the "user-centric approach" is largely an empty formula and, like others, it claims that the regulator should provide incentives for the grid operators. ERGEG stated in the Consultation Paper that grid operators will also be beneficiaries of smarter grids (and this is already as an incentive for them). However, ERGEG believes that cost-benefit assessments are needed for NRAs to evaluate whether and in which cases this is a sufficient incentive.

2.2.2 Role of energy suppliers and energy service companies

The respondents support ERGEG's Consultation Paper that energy suppliers and energy service companies can make a substantial contribution and have to be involved, like all others, in order to coordinate the development for promoting compatibility of smart grid applications and technology. According to some respondents, energy suppliers and energy service companies are expected to take the lead in the deployment of smart grids by looking for cost-effective solutions as they can better understand the needs of their customers[6]. This point is complementary to ERGEG's position: TSOs and DSOs are the prime movers for the deployment of smart grids and they will allow new marketplaces and opportunities for suppliers and energy service companies.

Some respondents argue that there must be a common interface between energy suppliers and energy service companies and DSOs/TSOs to ensure non-discrimination to all players and that it will be necessary to agree on common standards for the exchange of data and information which might be shared with third party companies. It is also necessary to consider any measures imposed by regulators to ensure that network users are treated fairly with regard to opportunities to participate and sharing the associated costs. ERGEG's position that roles and responsibilities must be clearly defined and duly committed is supported by respondents who also see the

[6] In this paper, we usually refer to network users including consumers and producers (and those that have both roles). They are also "customers" of energy suppliers and energy service companies.

necessity to clearly distinguish between the roles of suppliers, metering point operators, metering service providers and grid operators to clearly allocate investments.

Other respondents request that there is a clear distinction between the treatment of innovations from the grid operators and those that can result from market parties and healthy competition. The need for a clear distinction is further remarked upon by ERGEG in Section 2.3.7.

2.2.3 Current and future needs of network users

Most respondents believe that the major areas of the current and future needs of network users have been properly identified in the Consultation Paper. The transition towards smart grids will be an evolutionary process and new requirements may emerge over time. They agree with ERGEG that the needs and the services they require from the retailers, aggregators and third parties are expected to evolve over time. The allocation of costs should be shown transparently to consumers. Consumer associations emphasise that higher commodity prices will be another factor affecting the electricity price. Therefore, it is absolutely key to take the price effects always into account.

As in ERGEG's position paper, system security issues and quality of supply were noted as important needs of grid users. It was also remarked that the regulatory focus should be to provide satisfactory levels of quality and security of supply. Some respondents, especially from Germany, hold the position that quality of supply is not limited to the introduction of smart grids, and can be provided with the present technology. ERGEG agrees that satisfactory levels of security and quality of supply - see also effect and benefit (4) in Section 2.3.2 - are reached and can be reached in many cases by conventional grid solutions.

2.2.4 Network challenges and possible solutions

The majority of respondents agree in general with the network challenges and possible solutions identified in the Consultation Paper (Sections 3.4 and 3.5). However, for some of them the list is not complete, which is explainable due to different understandings on classification of the energy system as a whole and the role of regulation and grid operation.

Additional challenges occur for transmission system operators as a result of the difficulty to build additional transmission facilities - NIMBY (Not In My Back Yard) issues - and the local opposition to nearly any kind of grid expansion project.

Furthermore, increased growth in distributed generation and some new user requirements should be considered when referring to network capacity planning. There is a common understanding among respondents that the future grid will increase the complexity of the network and difficulties with regard to maintenance and repairs. Lifetime expectancies of IT products are considered to be shorter than current primary network components/installations. Controlling voltage quality will become a more complex issue and should be highlighted together with security. The role of other stakeholders besides the network operators should be taken into

account even more. Dealing with cost-benefit analysis, the real long term costs should have to be systematically assessed and considered. In general, ERGEG agrees with the statements above and takes this list of challenges into account in its considerations.

In contrast, there is a very different understanding concerning the role of smart metering in the development of smart grids. There is a very wide spread of opinions in this regard, ranging from those who see big opportunities for integration of services based on smart metering for consumers on low voltage level and others that are not of this opinion. As stated in the Consultation Paper, ERGEG believes it possible to have smarter distribution and transmission networks without smart metering and that the approach to their joint development will best be decided at national level (see also Section 2.1.3 of this paper with regard to this issue).

2.2.5 Future costs of smart versus conventional network solutions

ERGEG agrees with the majority of the responses on the fact that in the longer term smart grid solutions are expected to significantly reduce the costs of supporting the expected growth of alternative renewable generation. Smart grid investments are not comparable with the “fit and forget” strategy whereas the future outlook is estimated in very different ways. The integration of renewable energy sources (RES) in the network is seen as a challenge but at the end of the day the benefits of better controllability, efficiency, quality and security of supply will justify the required investments.

Many parties made the point that regulators should take care for a framework to incentivise behaviour and provide appropriate investment signals in order to drive networks and the supply chain to employ the most efficient/cost effective solutions. The group of service providers is convinced that grid operations will be more cost effective with smarter grid solutions. There is no expectation that the prices for smart grids technology will rise in the coming years.

2.2.6 Regulatory challenges

ERGEG discussed in the Consultation Paper a number of regulatory challenges: enabling new services with a technology-neutral role; removing barriers e.g. by decoupling grid operators' profits from volumes, prioritise efficient smart solutions; ensuring stable long term return investments; pushing grid companies to be user-centric; and the overarching challenge of incentivising innovation.

ERGEG considers that from a regulatory perspective some of the proposals mentioned by respondents should be taken into account as far as they are not already included in the different regulation schemes across Europe considering the contradictory opinions of different stakeholder groups.

For instance, network operators are of the opinion that regulators will have the duty to encourage companies to spend money on innovation for the benefit not just of today’s but also future network users. Stable arrangements are requested to be put in place that recognise the

uncertainty linked to investment in innovation (for instance offering companies a higher rate of return for managing the extra risk of some types of investments and establishing clear ground rules for the treatment of stranded assets due to unexpected developments). Grid operators request regulators guarantee adequate finance for DSOs and TSOs to cover the investments required by the installation of smart grids. This could be achieved through the definition of incentives that do not prevent a fast evolution to economically-balanced models in order to encourage innovation and effectiveness.

According to the responses of service providers, the main task of regulatory authorities is to incentivise the grid companies pursuing innovative technologies and spread the costs of the smart grids development among actors according to the benefits they derive.

2.3 Priorities for regulation

2.3.1 Output and input regulation

Respondents were asked whether they agree that regulators should focus on outputs (i.e. the benefits of smart grids) rather than inputs (i.e. technical details).

ERGEG recognises that most respondents fully agree that regulators should mainly focus on outputs in their regulation of the distribution and transmission grids. ERGEG agrees also with those respondents mentioning that it is important to design the regulatory means both from an economic and technical perspective. Further, it should be emphasised that developing a smarter grid is not a goal in itself, but is a means to an end, i.e. a regulatory approach towards smart grids alone, is not envisaged.

Even though the main focus will be on outputs, technical details such as input regulations cannot be neglected in all cases, e.g. related to the framework guidelines approach for the preparation and approval of ENTSO-E network codes, as foreseen by the Regulation EC 714/2009 [2] and related to many standardisation issues which usually fall into input regulation[7]. The messages already included in the Consultation Paper coincide with these viewpoints in ERGEG's opinion.

2.3.2 Effects and benefits expected by Smart Grids

There was a quite general consensus on the list of effects and benefits which ERGEG proposed in the Consultation Paper. However, some additional proposals and integration were made by respondents. Some of these are already indirectly covered by the proposed list 1) – 7) in the Consultation Paper, please see the annexes for more detailed comments. However, based on the comments received, ERGEG modifies the list (see also Section 2.3.3) to the following:

[7] A case in which standardisation covers output regulation issues is the voltage characteristic of electricity. Indeed in this case, after four years of cooperation of CEER experts with CENELEC, a new version of the European Norm EN50160 "Voltage characteristics of electricity supplied by public distribution networks" was ratified in March 2010.

(1) Increased sustainability
(2) Adequate capacity of transmission and distribution grids for "collecting" and bringing electricity to consumers
(3) Adequate grid connection and access for all kinds of grid users
(4) Satisfactory levels of security and quality of supply
(5) Enhanced efficiency and better service in electricity supply and grid operation
(6) Effective support of trans-national electricity markets
(7) Coordinated grid development through common European, regional and local grid planning to optimise transmission grid infrastructure
(8) Enhanced consumer awareness and participation in the market by new players

ERGEG agrees with the comments received about the national differences in quantifying (and perceiving) the value of each effect and benefit listed above. Some comments also said that incentives should be given to DSOs in order to invest, and that investments for smart grids might benefit several parties but are often only done by DSOs. ERGEG agrees that allocation of benefits should be taken into account to the extent possible; hence sound cost and benefit analysis is a necessary tool in the process. However, there can also be "side-benefits" in addition to original intended benefits, as also mentioned in the comments, e.g. enhanced industrial competitiveness in Europe due to export potential of new technologies for smart operation to third countries. This can be an important issue for some actors.

Some respondents argued and ERGEG agrees that regulation of outputs is not strictly limited by the relationship to smart grid solutions, but can apply as a (complementary) regulation path for electricity networks. Putting the main focus on output regulation could be the better approach to ensure that users receive value for money they spend in electricity grids.

2.3.3 Performance indicators and output measures for future Smart Grids

There was a quite general consensus on the list of performance indicators which ERGEG proposed in the Consultation Paper. Some respondents proposed additional performance indicators. New indicators which are believed promising by ERGEG for further consideration at national level about the new benefit (8) are the following:

- *Percentage of consumers on (volunteer) time-of-use / critical peak / real time dynamic pricing*
- *Measured modifications of electricity consumption patterns after new (volunteer) pricing schemes.*
- *Percentage of users available to behave as interruptible load.*
- *Percentage of load demand participating in market-like schemes for demand flexibility.*
- *Percentage participation of users connected to lower voltage levels to ancillary services*
- *Demand side participation in electricity markets and in energy efficiency measures (moved from benefit (5) in the Consultation Paper)*

According to ERGEG's statement that technology is not an end in itself but rather a means to an end, the following indicator proposed by various stakeholders is not a performance indicator:

- ~~*Percentage of coverage by smart meters.*~~

Further, new indicators proposed are:

Referring to benefit (1):
- *Environmental impact of electricity grid infrastructures.*

Referring to benefit (4):
- *Measured satisfaction of grid users for the "grid" services they receive.*
- *Power system stability performance.*

Referring to benefit (5):
- *Percentage utilisation (i.e. average loading) of electricity grid elements.*

Referring to effect (7):
- *Time for licensing/authorisation of a new electricity transmission infrastructure.*
- *Time for construction (i.e. after authorisation) of a new electricity transmission infrastructure.*

As already anticipated in the Consultation Paper, ERGEG agrees with the comments received about the following:

- National differences determine that the choice of the best indicators to be implemented can vary from country to country.
- The need that, when used with economic effects, performance targets and indicators should be cleansed from external effects outside the control of network operators.
- The need for a thorough evaluation of the best output measures to be implemented in form of reward/penalty compensation mechanisms.
- For all targets to be set, it is important to have clear and transparent measurement rules so that all targets are observable, quantifiable and verifiable.
- It is important to ensure a complete regulation and long-term reasonable rate of return and to avoid sub-optimisation for some indicators.

Many respondents provided useful insights about alternative performance indicators for quality of supply; in particular energy not supplied (ENS) has been mentioned. A number of indicators for quality of supply exist, as explained also in the 4th CEER Benchmarking Report on Quality of Electricity Supply [3]. However, mentioning duration and frequency does not exclude other useful indicators for the same benefit, and the most appropriate indicator can only be determined at national level.

Finally, there were contradicting opinions on the opportunity to have a European benchmarking of some selected performance indicators, especially due to national differences and factors affecting the indicators. The experience of CEER in benchmarking the quality of electricity supply from 2000 to 2008 proved to be useful to NRAs in understanding and regulating especially continuity of supply, including a greater awareness of some structural differences. It

has to further evaluated whether the possible benchmarking of other performance indicators will prove to be cost-benefit effective.

The revised list of effects and benefits and potential performance indicators for each benefit is presented in the following tables.

Effects/Benefits	Potential performance indicators
(1) Increased sustainability	Quantified reduction of carbon emissions Environmental impact of electricity grid infrastructure
(2) Adequate capacity of transmission and distribution grids for "collecting" and bringing electricity to consumers	Hosting capacity for distributed energy resources ('DER hosting capacity') in distribution grids Allowable maximum injection of power without congestion risks in transmission networks Energy not withdrawn from renewable sources due to congestion and/or security risks
(3) Adequate grid connection and access for all kind of grid users	Benefit (3) could be partly assessed by: - first connection charges for generators, consumers and those that do both - grid tariffs for generators, consumers and those that do both - methods adopted to calculate charges and tariffs - time to connect a new user
(4) Satisfactory levels of security and quality of supply	Ratio of reliably available generation capacity and peak demand Share of electrical energy produced by renewable sources Measured satisfaction of grid users for the "grid" services they receive Power system stability performance Duration and frequency of interruptions per customer Voltage quality performance of electricity grids (e.g. voltage dips, voltage and frequency deviations)

Table 8: Effects/benefits of smartness and list of potential performance indicators (part 1)

Effects/Benefits	Potential performance indicators
(5) Enhanced efficiency and better service in electricity supply and grid operation	Level of losses in transmission and in distribution networks (absolute or percentage) Ratio between minimum and maximum electricity demand within a defined time period (e.g. one day, one week) Percentage utilisation (i.e. average loading) of electricity grid elements Availability of network components (related to planned and unplanned maintenance) and its impact on network performances Actual availability of network capacity with respect to its standard value (e.g. net transfer capacity in transmission grids, DER hosting capacity in distribution grids)
(6) Effective support of trans-national electricity markets	Ratio between interconnection capacity of one country/region and its electricity demand Exploitation of interconnection capacity (ratio between mono-directional energy transfers and net transfer capacity), particularly related to maximisation of capacity according to the Regulation on electricity cross-border exchanges and the congestion management guidelines Congestion rents across interconnections
(7) Coordinated grid development through common European, regional and local grid planning to optimise transmission grid infrastructure	Benefit (7) could be partly assessed by: - impact of congestion on outcomes and prices of national/regional markets - societal benefit/cost ratio of a proposed infrastructure investment - overall welfare increase, i.e. always running the cheapest generators to supply the actual demand) → this is also an indicator for benefit (6) above. - Time for licensing/authorisation of a new electricity transmission infrastructure. - Time for construction (i.e. after authorisation) of a new electricity transmission infrastructure.
(8) Enhanced consumer awareness and participation in the market by new players	Demand side participation in electricity markets and in energy efficiency measures Percentage of consumers on (volunteer) time-of-use / critical peak / real time dynamic pricing Measured modifications of electricity consumption patterns after new (volunteer) pricing schemes. Percentage of users available to behave as interruptible load. Percentage of load demand participating in market-like schemes for demand flexibility. Percentage participation of users connected to lower voltage levels to ancillary services

Table 9: Effects/benefits of smartness and list of potential performance indicators (part 2)

2.3.4 Encouraging innovation along research, development, demonstration chain

Some respondents argued that it could be difficult to encourage innovation through the definition of performance indicators and output measures. Indeed, performance indicators for demonstration projects are different with respect to key performance indicators (KPIs) for deployment as they should include replicability and dissemination and amount of activities devoted to training. KPIs for demonstration will also depend a lot on what is actually being trialled. It was remarked, and ERGEG fully agrees, that the performance-based approach could fit well the deployment phase, whereas different approaches for incentivising the demonstration phase might be opportune.

As anticipated in the Consultation Paper, ERGEG recommends NRAs ensure dissemination of the results of demonstration activities funded or incentivised by network tariffs and other public

funds at European and national level, in order to minimise the risk of replicating the “mistakes” which may occur when carrying out research, development and demonstration and the consequent stranded costs.

Further, ERGEG recommends NRAs continue their exchange of expertise at European level, in order to learn as soon as possible from the (first) best regulatory practices. One of these cooperation activities is the participation of ERGEG representatives in the preparation of the Strategic Energy Technology Plan – European Electricity Grid Initiative promoted by the European Commission [4]. The outcome of this participation was the ERGEG suggestions which can be useful for national evaluation of demonstration projects:

- identification of what it is research, development, demonstration and deployment;
- ex ante and ex post assessment of benefits;
- ensure market participants as point of contact to the customers assuring that independent market operators are involved in measuring benefits;
- replicability and openness of projects;
- transparent validation procedures;
- well-defined and transparent criteria for monitoring of demonstration projects;
- evaluation of project indicators tailored to each demonstration allowing to measure projects’ results; and
- ensure proper coordination among research projects, including avoidance of overlapping and duplication.

ERGEG still holds the view that, relying upon the subsidiarity principle, it will remain up to each NRA to evaluate the benefits and the costs of the possible lighthouse or demonstration projects, according to national priorities and in coherence with the applicable national regulation systems.

2.3.5 Standardisation, harmonisation and interoperability

There were differences in the responses to ERGEG question number 15 about whether existing standards or lack of standards represent a barrier to the deployment of smart grids. Most respondents replied that yes, this represents a barrier to the deployment of smart grids. However, other replies indicated that sufficient standards are available, and even that the problem can be too many standards available.

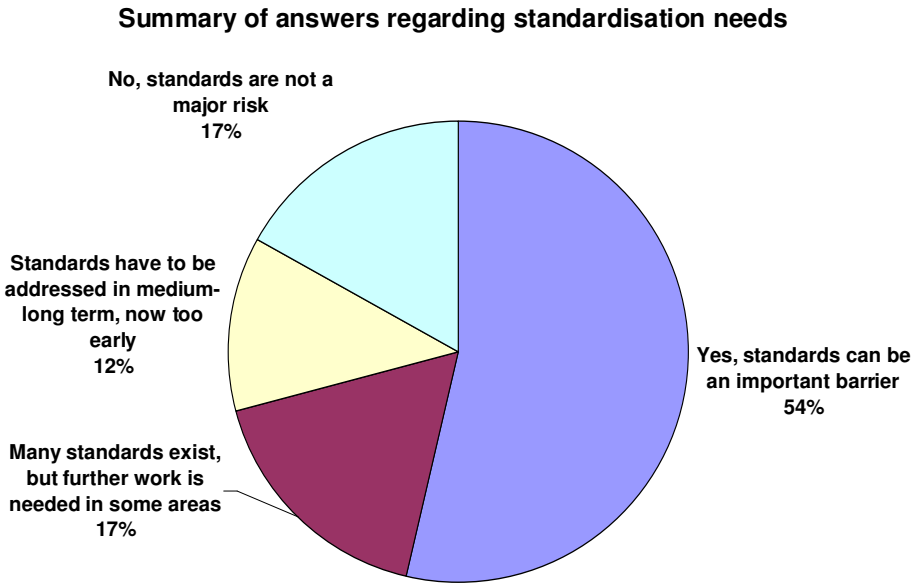

Figure 2: Allocation of replies from stakeholders with respect to whether existing standards or lack of standards represent a barrier to the deployment of smart grids.

A few respondents pointed out the importance of European network codes (and the related framework guidelines by the Agency) to support interoperability. ERGEG agrees that grid codes, which originate as an industry self-regulation and internal standardisation process, can promote harmonisation and interoperability in the European electricity market and system.

As already mentioned in Section 1.4, the European Commission has established a task force for the implementation of smart grids in the internal energy market. This task force is dealing with inter alia services and functionalities for smart grids and meters and a standardisation strategy for smart grids. ERGEG actively participates in the activities giving advice to the European Commission.

The three European Standardisation Organisations (ESOs) have established a focus group on standards for the smart grid. The Focus Group, including participation of regulators, will advise on European requirements relating to smart grid standardisation, and assess ways to address them.

2.3.6 Other barriers to smart grid deployment

The respondents were asked whether they believed that other barriers to deployment than those mentioned in the Consultation Paper could be identified. A significant number of respondents observed that all barriers were addressed in the Consultation Paper and did not identify

additional barriers. However, some respondents provided a list of additional barriers, sometimes including the ones already mentioned in the Consultation Paper.

Some of the barriers mentioned are: Uncertainty, lack of clear roles and responsibilities, data management, security and privacy issues, political will, regulatory structures and alignment of incentives, market requirements, ineffective implementation of unbundling, insufficient supporting schemes for RES, lack of definition of smart grids functionalities, safety and more. ERGEG has taken note of all comments; please see the annexes for more details. ERGEG believes that some of these tentative barriers can be solved through the European Commission's task force for the implementation of smart grids in the internal energy market, as this task force plans also to deal with definition of roles and responsibilities and issues related to data handling, data protection and data safety. ERGEG agrees that possible barriers should be identified, and considered. Their impact will differ across Europe; however, ERGEG still considers that there are no fundamental barriers to the deployment of smarter distribution and transmission systems where necessary and cost-efficient.

One other barrier, not mentioned in the Consultation Paper, referred to the availability of skilled workforce (especially with reference to the knowledge of innovative solutions). Indeed, one respondent mentioned as a possible performance indicator the percentage of time / human resources devoted to training activities. ERGEG agrees that sufficient trained, educated and available personnel are necessary now and in the future, however, the means to achieve this need to be further elaborated and discussed by relevant parties, mainly at national level.

Engagement of grid operators with their network users was mentioned as an important item for the deployment of smart grids. In addition, the need for the engagement of suppliers (and more generally, players acting in competitive markets) with their customers was mentioned. ERGEG believes that this is an important issue for an effective user-centric deployment of smart grids. ERGEG believes that a possible regulatory approach to promote user and customer engagement is carefully to address the regulation of commercial quality (i.e. information, customer treatments, etc. provided by regulated parties to their users and customers).

2.3.7 Risk of cross subsidies

Generally, the respondents appreciated the issue raised by Consultation Paper about the possible risk of cross-subsidies across TSO network activities, DSO network activities and non-network activities by the same holding companies.

It is interesting to observe significant differences among the answers of different groups to this question of the Consultation Paper:

- Whereas the four responding TSOs observed no risks (or do not explicitly reply), mainly due to unbundling provisions, all six DSOs which explicitly replied envisaged risks of cross-subsidies.
- Industry Associations did not seem concerned that cross-subsidising between TSOs and DSOs would be any problem; to the extent this is necessary due to the nature of their

businesses. However, they have some more concern towards new services and non-regulated companies. One respondent emphasises that it should be prevented that users and especially vulnerable users are charged for expenses and developments they will hardly benefit from.

- The research/ Consultant group see that cross-subsidies can happen, but the risk can be reduced by regulatory measures, inter alia a more efficient unbundling also of distribution system operators. One of the respondents in this group answers clearly that there are no risks of cross-subsidies, another one that intelligent regulatory rules can prevent any cross-subsidising between stakeholders.

As anticipated, ERGEG believes that TSOs and DSOs are the prime movers for the deployment of smart grids, also by allowing new marketplaces and opportunities for suppliers and energy service companies. With respect to the latter, it is evident that grid tariffs do not pay expenses by actors in competitive markets.

In addition to a careful implementation of unbundling provisions, a thorough evaluation of the distribution of costs and benefits related to smart grids across the whole supply chain and a clear identification of roles and responsibilities of the different stakeholders were mentioned as instruments to avoid future cross-subsidies. With respect to the latter, the ongoing activities within the task force on smart grids promoted by the European Commission (see Section 2.3.5) focus on roles and responsibilities and can contribute regarding these matters.

2.3.8 Priorities for electricity grid regulation and for regulators

The respondents were asked what they believed to be the regulatory priorities for electricity networks in relation to meeting the 2020 targets. The Consultation Paper proposed three main priorities for regulators, as recapped in Section 1.2 of this paper:

- to concentrate on outputs of the regulated entity, by tailored regulatory mechanism;
- to favour cooperation among stakeholders, with special care to standardisation, also in order to identify the possible barriers to smart grid deployment; and
- to encourage an adequate level of innovation, whereas protecting consumers by the identification of costs and benefits of smart grid demonstrations and deployed solutions.

As already discussed, ERGEG received a substantial agreement, though some different answers by some respondents emerged. Further, the question about regulatory priorities for electricity networks raised a number of responses related to specific fields of the electricity networks. The most frequent comment, especially posed by the category of grid operators, was the request of stability of the regulatory framework related to investments. With respect to this, ERGEG believes the stability of the regulatory framework is a needed pre-condition to allow investments in transmission and distribution grids. Given that changes in the electricity grid sector will arise as recognised in other parts of this paper, NRAs are recommended to pursue the stability of the regulatory framework to the extent possible and suitable. ERGEG still holds the view expressed in the Consultation Paper that it is important to ensure a complete regulation and long-term reasonable rate of return.

3 Conclusions and recommendations

After stating preliminary views and considering the responses from stakeholders to the Public Consultation, ERGEG has drawn a set of conclusions from the consultation process. ERGEG has also made a number of recommendations that should be taken account of, where appropriate, by European and national decision-makers. These recommendations and conclusions do not pre-empt the validity of the views and recommendations presented in the Consultation Paper (Ref. E09-EQS-30-04), unless otherwise stated in this Conclusions Paper (Ref. E10-EQS-38-05).

The ERGEG conclusions are:

C-1: there is an almost unanimous consensus that network companies are facing significant challenges in effectively playing their part in the low-carbon transition;

C-2: though most respondents broadly agree with ERGEG's definition on smart grids proposed in the Consultation Paper, there is still a real need to promote a common understanding of the term smart grids, although the understanding of the services, functionalities and solutions that smart grids will actually deliver in the future will evolve over time;

C-3: the roles and responsibilities of relevant stakeholders and authorities in the transition to smarter transmission and distribution grids must be clearly defined and duly committed;

C-4: a significant number of stakeholders are calling for an urgent step change in the approach to the design, planning and operation of grids (especially distribution), requesting significant investment in innovation, well above the current investment levels, which should be supported at policy and regulatory level;

C-5: considering ways to encourage innovation, ERGEG believes that it is important to distinguish between research and development activities, usually (co-)funded by national or EU-wide public sources, and grid-specific demonstration or deployment (roll-out), where, according to national priorities and in coherence with the applicable national regulation systems, measurable benefits to identifiable users could justify an inclusion of costs in regulated tariffs;

C-6: the performance-based approach could fit well the deployment phase, whereas different approaches for incentivising the demonstration phase might be opportune;

C-7: agreement on beneficial effects and of their performance indicators is necessary to perform i) preliminary cost/benefit analyses before carrying out demonstration projects, and, most importantly, ii) final cost/benefit assessments after the demonstration phase in order to evaluate the opportunity of full scale roll-out of the tested smart grid solutions;

C-8: as long as deployment of smart grid solutions will be carried out, other barriers than those currently envisaged and addressed are likely to arise. Cooperation among stakeholders will be vital to identify them quickly. Thereafter, policy and regulatory attention must focus on finding solutions that provide an appropriate balance between all the stakeholders' positions.

ERGEG recommends the following:

R-1: to ensure, as appropriate, a long-term stable regulatory framework and reasonable rate of return for cost-efficient grid investments;

R-2: to consider and further analyse decoupling between grid operators' profits and the volumes of electricity they deliver, taking into account the introduction of performance indicators and performance-based incentive regulation;

R-3: to pursue regulation of outputs as a mechanism to ensure value for money paid by network users and to investigate metrics for the quantification of the most important output effects and benefits at national level;

R-4: to promote mechanisms favouring an improved consumer awareness of their electricity use and market opportunities through actions of suppliers and other market participants and an improved engagement of network operators with their network users;

R-5: to encourage the deployment of smart grid solutions, where they are a cost-efficient alternative for existing solutions, and as a first step in this direction, to find ways of incentivising network companies to pursue innovative solutions where this can be considered beneficial from the viewpoint of the society;

R-6: to evaluate the breakdown of costs and benefits of possible demonstration projects for each network stakeholder and to take decisions or give advice to decision-makers based on societal cost-benefit assessment which take into account costs and benefits for each stakeholder and for the society as a whole;

R-7: to ensure dissemination of the results and lessons learned from the demonstration projects in case they are (co-)financed by additional grid tariffs or from public funds to all interested parties, including other network operators, market participants, etc.;

R-8: to participate in 'smart grids' discussions and cooperation activities among stakeholders and especially to consider an active cooperation with European and national standardisation organisations, grid operators and manufacturers, for example on open protocols and standards for information management and data exchange, in order to achieve interoperability of smart grid devices and systems;

R-9: to clarify the difference between regulated grid activities and market opportunities for new services under a competitive regime (e.g. aggregation of resources, EV recharging) and to carefully monitor the possible presence of cross-subsidies between network activities by TSOs or DSOs and market-based activities;

R-10: to continue exchange of expertise at European level, in order to learn as soon as possible from best regulatory practices.

The conclusions and recommendations drawn from this experience will be important for ERGEG to effectively advise the European Commission in developing the future European policy framework for smart grids, as envisaged in the ongoing task force for the implementation of smart grids in the internal energy market. In addition to this and the other aforementioned active participation of CEER/ERGEG in several "smart grid" initiatives at European level, ERGEG is evaluating the opportunity for:

- analysing new elements of market design, business models and marketplaces which are expected to arise together with the future deployment of smart grids;
- carrying out a benchmarking activity at EU level to i) identify the current status of deployment of "smart" technologies across European grids and ii) select and quantify a few promising performance indicators and grid output measures.

Annex 1 – CEER and ERGEG

In 2000, ten national energy regulatory authorities signed the "Memorandum of Understanding for the establishment of the Council of European Energy Regulators" (CEER). They had voluntarily formed the council to facilitate cooperation in their common interests for the promotion of the internal electricity and gas market. In order to cope with a growing number of issues and to improve cooperation at the operational level, the regulators decided in 2003 to formally establish themselves as a not-for-profit association under Belgian law and to set up a small secretariat in Brussels. The Statutes (English version, Statutes amendment) were published in the annex of the Belgian State Gazette on October 21st, 2003. The CEER now has 29 members - the energy regulators from the 27 EU-Member States plus Iceland and Norway. CEER and the European Regulators Group for Electricity and Gas (ERGEG) share similar objectives and the work and achievements of the CEER and ERGEG are intrinsically linked.

The European Regulators for Electricity and Gas (ERGEG) was set up by the European Commission in 2003 as its advisory group on internal energy market issues. Its members are the energy regulatory authorities of Europe. The work of the CEER and ERGEG is structured according to a number of working groups, composed of staff members of the national energy regulatory authorities. These working groups deal with different topics, according to their members' fields of expertise.

This report was prepared by the Electricity Quality of Supply (EQS) Task Force of the Electricity Working Group.

Annex 2 – List of abbreviations

Term	Definition
CEER	Council of European Energy Regulators
Electricity WG	Electricity Working Group
EQS TF	Electricity Quality of Supply Task Force
ERGEG	European Regulators Group for Electricity and Gas
NRA(s)	National Regulatory Authority (Authorities)
BEUC	BEUC, the European Consumers' Organisation
CENELEC	European Committee for Electrotechnical Standardization
DSO(s)	Distribution system operator(s)
DG	(European Commission) Directorate General
EEGI	European Electricity Grid Initiative
ENTSO-E	European Network of Transmission System Operators – Electricity
ESO(s)	European standardisation organisation(s)
EU	European Union
EV(s)	Electric vehicle(s)
ICT	Information & communication technology
IT	Information technology
KPI(s)	Key Performance Indicator(s)
NIMBY	Not In My Back Yard
R&D	Research and development
R&D&D	Research, development, demonstration
RES	Renewable energy sources
SET Plan	Strategic Energy Technology Plan
T&D	Transmission and distribution
TSO(s)	Transmission system operator(s)

Table 10: List of Abbreviations

Annex 3 – Evaluation of responses

Annex 3 provides ERGEG's summary and evaluation of each single answer by each respondent.

Annex 3 is available in a separate file (Ref. E10-EQS-38-05a).