Pilot Framework Guidelines on Electricity Grid Connection

Initial Impact Assessment

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1 PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

Grid connection covers all issues to establish and to maintain a physical connection between the transmission and / or distribution grid and the grid customers. Grid connection is used here as a synonym for network connection, which is the area for a network code according to Article 8.1.b of Regulation (EC) 714/2009. In the context of this Initial Impact Assessment (IIA), grid connection requirements are considered as features and rules which the transmission and distribution grid operators, as well as the grid user have to meet, in order to maintain system security, availability and the proper functioning of the electricity market from a technical point of view.

1.1 The issue of grid access

This IIA addresses primarily the issue of electricity grid connection – the considerations on grid access (third party access in terms of e.g. contractual arrangements between the grid operator and grid user, general terms and conditions, etc.) are closely linked but they do not strongly overlap. Moreover, the grid access issues do not directly address the problems identified thereafter, which is why they will not be covered here in full detail together with technical grid connection issues - in order of priority, it is seen as necessary to establish harmonised connection rules first, because they will have a subsequent effect on third party access conditions. Meeting requirements for grid connection is a prerequisite for granting grid access to customers.

Even though grid access will therefore be the subject of a separate, future framework guideline, which will provide the basis for the related area for codes according to Article 8.1.c of Regulation (EC) 714/2009, the “cross-issues” of grid connection which are also related to grid access have been identified in this IIA and will be addressed accordingly in the future work on grid access.

1.2 Charges for grid connection

The question of the allocation of costs for grid connection between the grid operator and the grid user is indeed an essential one. With framework guidelines and codes generally focusing on the issues of relevance for the European Internal Electricity Market (IEM) – i.e. the “cross-border” issues – this question is then focused on the costs for connection to the transmission grid.

The turnover of Transmission System Operators (TSOs) is composed of the different transmission tariff components: use of system charges, charges for losses, charges for utilisation of the transmission grid by transits from neighbouring control areas (Inter-TSO Compensation, ITC), connection charges, etc.

Recently the EU Cross-Border Committee for Electricity approved the ITC Guidelines and the Transmission Tariffication Guidelines according to Article 8 of Regulation (EC) 1228/2003 (and Article 13 of Regulation (EC) 714/2009, applicable from March 2011). Whereas the ITC Guidelines address the compensation between TSOs for the use of the transmission grid for transits between the neighbouring control areas, the Transmission Tariffication (TT) Guidelines address transmission charges to be paid by producers and postulates [7] that the

" … *annual average transmission charges paid by producers are annual total transmission tariff charges paid by producers, divided by the total measured energy injected annually by producers to the transmission system of a Member State…*". Moreover, the TT Guidelines also state that "… *the transmission charges shall exclude (1) charges paid by producers for physical assets required for connection to the system or the upgrade of the connection; (2) charges paid by producers related to ancillary services; (3) specific system loss charges paid by producers …*"

Bearing in mind the above, it follows that – even though the TT Guidelines refer to transmission grid charges – their scope is not wide and a very small portion of the transmission connection charges is actually addressed there. It follows further that the portion of transmission charges which will be harmonised EU-wide by the TT Guidelines is rather small and the largest portion of the transmission grid charges still remains under the responsibility of the Member States' regulation.

The approach taken in this IIA has therefore been to identify the issues which are relevant for grid connection charges and – where applicable – also propose possible future considerations and options for harmonisation within the scope of the future (revised) TT Guidelines. For now, EU-wide harmonisation of the costs for grid connection – grid connection charges harmonisation – is outside of this IIA scope. Moreover, the issues of TT Guidelines and the question of charges for grid connection are not directly related to the problems identified thereafter.

1.3 Rationale behind the initiative and ERGEG mandate

At the heart of the 3rd Package[1] is the development of EU-wide network codes on topic areas for the integration of EU electricity and gas markets, enabling cross-border trade and competition to develop across EU energy markets. The process for developing these codes is stipulated in the legislation and includes the elaboration by energy regulators (Agency for the Cooperation of Energy Regulators, ACER) of framework guidelines (FG), which set out the key principles for the development of the network codes by the transmission system operators (European Network of Transmission System Operators for Electricity, ENTSO-E).

Since the provisions of the 3rd Package will not be applicable until 3 March 2011, ERGEG have been committed to making as much progress as possible in preparing the work on FG during the interim period and will therefore provide input to the European Commission and the ACER on the preparatory work on FG.

The 16th Florence Forum in June 2009 outlined the essential elements of the 3rd Package and made suggestions on how to efficiently use the interim period in order to pave the path for its implementation. In particular, the electricity pilot project to prepare the framework guidelines and the related network codes was discussed. In its conclusions, the Forum welcomed the idea of a pilot project and agreed that the FG for Grid Connection is a suitable topic for the Pilot Project in electricity. This is why ERGEG has been committed to the Pilot

[1] The 3rd legislative Package proposals for the European Internal Market in Energy were finally adopted on 13 July 2009 and include 5 legislative acts, which can be viewed at: http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:211:SOM:EN:HTML

Project on Electricity Grid Connection to test the end-to-end process and to allow for adjustments if case of problems identified in implementing the legal process.

It is within this context, that ERGEG has been invited by the European Commission to draft pilot framework guidelines on connections policy – the background information and expected results were outlined in the letter [8] from the Director of the European Commission DG for Energy to the ERGEG President, of 26 March 2010 (enclosed in Annex 2)

In order to ensure that the development of FG meets the best regulatory practice, the Electricity Pilot Project is organised in two steps:

1. Step 1: Initial Impact Assessment for justification (this document);

2. Step 2: Draft framework guidelines for grid connection, 2 months of public consultation and revision of the guidelines accordingly after the consultation.

An ad hoc Expert Group was set up with the purpose of providing input/assistance to ERGEG (later ACER) in relation to the specific issues relevant to a particular topic. The expert group members are listed in Chapter 1.5.

1.4 Organisation and timing

Article 6 of Regulation (EC) No 714/2009 (Regulation) on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003 (old Regulation) sets out the provisions for the establishment of network codes. The European Commission shall request that ACER submits to it within a reasonable period of time not exceeding six months non-binding framework guidelines setting out clear and objective principles for the development of network codes relating to the areas identified in Article 8, paragraph 6 of the Regulation. ACER shall formally consult ENTSO-E and the other relevant stakeholders in regard to the framework guidelines. Following the preparation of the code by ENTSO-E, ACER provides its reasoning and opinion to ENTSO-E on the draft code, which may then require amending by ENTSO-E. Once ACER is satisfied that the network code is in line with the relevant framework guidelines, ACER shall submit the network code to the European Commission and may recommend that it be adopted within a reasonable time period.

In view of these provisions, ERGEG began preparing the work of ACER, which will not be fully operational until March 2011. During 2010, the regulators will complete the pilot framework guidelines for electricity grid connection.

Figure 1 outlines the process for the development of the framework guideline, including the involvement of stakeholders through workshops and public consultation[2].

[2] "GA" stands for the European Energy Regulators' General Assembly

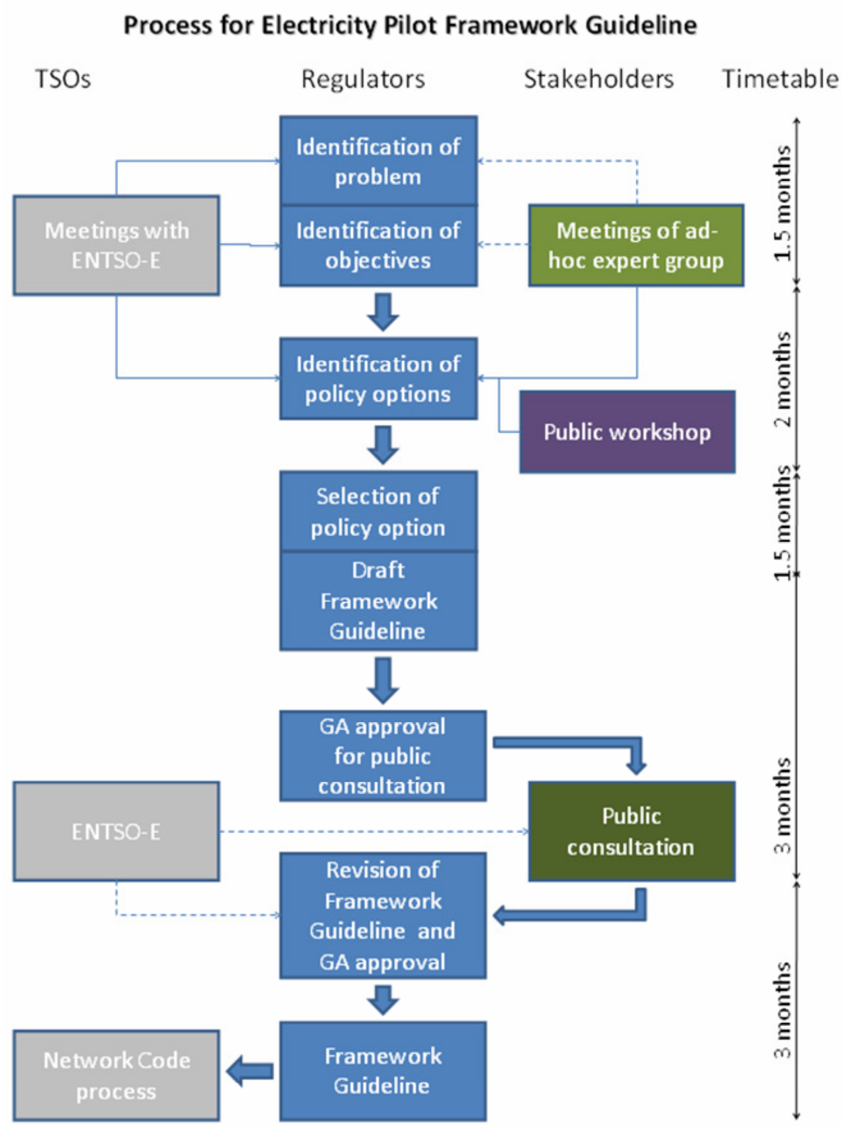

Figure 1: Block diagram of the process primarily foreseen for the development of the framework guidelines

After the public consultation, the draft pilot framework guidelines will be revised accordingly to finalised framework guidelines for grid connection. When this work is completed, ENTSO-E will draft the pilot network code for grid connection, based on the finalised framework guidelines.

1.5 Consultation and expertise

Following the 15 September 2009 publication of an open letter inviting candidates for an ad hoc Expert Group on electricity grid connection, ERGEG appointed 11 members, as part of the process for the development of framework guidelines. This ad hoc Expert Group participated in the electricity pilot project to test the process as set out in the 3rd Package legislation, most notably by supporting the problem identification and definition of objectives within this Initial Impact Assessment.

The terms of reference for the Expert Group on grid connection, with specific expertise criteria for the experts, were provided in Annex 1 of the open letter (www.energy-regulators.eu).

The Expert Group members are:

Rafael Bellido, Spain (Iberdrola)

Matthias Boxberger, Germany (E.ON Energie AG)

Bernd Klöckl, Austria (Verbund Austrian Power Grid AG)

Riccardo Lama, Italy (ENEL Distribuzione)

Claire Maxim, UK (EON UK)

Mark Norton, Ireland (EirGrid)

Ralph Pfeiffer, Germany (Amprion GmbH)

Thomas Karl Schuster, Austria (Wien Energie Stromnetz Ltd)

Pablo Simon, Spain (Endesa)

Andrea Vittorio Siri, Italy (Edison Trading S.p.A.)

Frans Van Hulle, Belgium (EWEA)

The Expert Group members have participated in the work on this Initial Impact Assessment in their capacity as experts in their specific fields of expertise, but not representing the interests of their companies. The details on the roles of experts and work of the Expert Group have been described in the invitation letter and are also available at www.energy-regulators.eu.

Before setting up the Expert Group, ERGEG conducted a number of coordinating discussions with ENTSO-E, in order to exchange views and establish a preliminary common understanding of the issues.

1.6 Public workshop

In line with the process in Figure 2, ERGEG held a public workshop on the electricity pilot project for framework guidelines on grid connection on 16 April 2010.

The subject of the workshop was the first draft IIA. The questions raised at the workshop, the results of discussion and the suggested changes to the IIA by the workshop participants are summarised at the webpage www.energy-regulators.eu, under the respective area: framework guidelines → electricity → pilot → public workshop. Those results have been integrated accordingly in this final draft IIA document.

Moreover, following discussions with the European Commission in the second half of April 2010, the suggestions from the European Commission have been formulated accordingly and the IIA document adapted in its format and contents – while not changing the contents of identified problems and objectives, the structuring and assessment of policy options have been adjusted and refined.

2 PROBLEM DEFINITION

2.1 What is the general / policy context?

European energy policy is currently focused on three major energy challenges: climate change, security of supply (i.e. the security of transmission and distribution system operation and the availability of primary energy sources at the heart of which is the increasing dependence on imports) and the ongoing objective to create the European Internal Energy Market.

As one of its key means for combating climate change, the EU has set targets for renewable energy. The EU has agreed to increase the share of renewable energy in its overall energy mix to 20 percent, a commitment which will have significant consequences to the electricity sector. In 2006[3], the share of electricity generated from renewable energy amounted to some 16 percent and under the new Directive on Renewable Energy[4] it is expected to double, to over 30 percent for the EU to reach its overall renewable energy target of 20 percent by 2020.

EU policy and related national policies to increase the share of renewable energy in electricity generation have led to a change in generation mix and its location. Increases in large scale on- and offshore wind generation are already being seen, and increasing penetration of generation connected at the level of distribution networks (e.g. wind, PV, CHP etc) is expected. The changing mix of generation across Europe is having an impact not just on the countries that host large amounts of renewable and distributed generation, but on all those that are part of the synchronous transmission system (synchronous area).

Alongside this increase in intermittent renewable generation, there is also increasing interconnection of national systems, both physically and via harmonisation of approaches to cross-border trade and coupling of power markets. National boundaries are becoming less distinct as the IEM matures and delivers more efficient utilisation of cross-border capacity. This is enabling increasing power flows over long distances that results in system operation closer to its security and stability limits.

Historically, transmission and distribution systems were planned together with the allocation of generation facilities by vertically integrated utilities. However, in the current context of market liberalisation and unbundling of network and generation functions, electricity transmission and distribution grids are separated from generation. Grid operators have no direct influence on the location or operation of generation plant. Consequently, grid connection rules have been developed to support the efficient integration of generation according to the requirements of national electric power systems.

[3] Communication from the Commission to the Council and the European Parliament the Renewable Energy Progress Report Commission Report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan COM(2005) 628 {COM(2009) 192 final} Brussels, 24.04.2009 SEC(2009) 503 final

[4] 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. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

Pressure from the large scale increase in intermittent generation is prompting development of new connection requirements to reflect the different operating characteristics of these generators. System operators are developing new connection requirements to ensure that all customers can be engaged in system operation (e.g. providing different services from blackstart capability to demand response). In parallel with this, the growing level of interconnection of national markets is adding a pressure to ensure that the grid connection rules do not have an adverse impact across the European network.

2.2 What is the issue or problem that may require action?

In this context, the overarching problem is that each national electric power system has developed different requirements from each of its neighbouring systems. Each national system has specific technical requirements for generators requesting connection, and its own approach to system operation.

With respect to differing requirements on generators in different national systems, this results in two further issues: additional manufacturing costs, as manufacturers must provide specific modifications to suit each national system, and (from an operational perspective) an uncoordinated response from generators in neighbouring systems when they reconnect after a system fault. Furthermore, interpretation of these connection requirements may in some cases be ambiguous or not sufficiently comprehensive, resulting in misinterpretation and variance in application of the rules within national systems too.

For system operation, the accuracy and binding character of rules differ between TSOs and Member States. This may lead to adverse consequences in the national markets / control areas and may also have impact on adjacent control areas through interconnections. Across Europe, there is also an absence of automatic system management features (particularly at distribution level) that could assist in coordination of action and might reduce balancing power requirements as well as a lack of coordination and consistency in the technical requirements for participation in provision of ancillary services.

In the light of increased penetration of intermittent generation, and interconnectedness of Member States' control areas through market integration, this lack of harmonisation between national systems is leading to unsafe and uncontrolled system operation. This is exposing the entire European network to further threats like the system split of UCTE experienced in November 2006. The findings of system studies ([1], [2], [3], [4]) clearly indicate that the security of the system can be endangered when generation and consumption units are tripped from the system in an uncoordinated and uncontrolled manner due to different national requirements on tolerating voltage and frequency variations.

In addition, there are a number of specific problems that are exacerbating or preventing resolution of this overarching problem of a lack of harmonisation of national requirements. These are: insufficient communication and information sharing between parties involved in system operation, lack of consideration for some specific generation technologies (most notably large-scale intermittent generation like wind and distributed generation) and provision for demand response.

Insufficient communication and information sharing between parties involved in system operation, both within national systems, and between Member States has the inevitable impact of preventing informed coordinated action (for example, during reconnection procedures following a system fault). This undermines the safety of system operation and thus increases the risk of system disturbance and can prolong the time to get the system back to a normal operating state.

This issue manifests itself between parties in several areas: interactions TSO to TSO, TSO to DSO, TSO and DSO to generators. All these interactions are held back by a fundamental lack of availability of real-time information, and also a lack of transparency of operational data (from TSOs, DSOs, generators and load). In many instances, there is often an inadequate contractual basis with which to share this information (where it is available), and many of the rules around information sharing and transparency have limited enforceability.

With the growing levels of renewable generation connecting to the system, high levels of both large-scale intermittent and distributed generation present problems for system operation that contribute to the impacts noted above. The characteristics of intermittent generation place additional burdens on the system operator in terms of provision of balancing services and, as penetration and market integration increase, this may have balancing implications for neighbouring systems too. In addition, there have been some examples where the behaviour of large-scale intermittent and of distributed generation during and following a fault on the system imposes unexpected burdens on the system operator and in some cases exacerbates and propagates the fault.

For demand response, there is a widely shared view that it has the potential to play a role in assisting with system operation in both normal and fault conditions. However there is a paucity of requirements set out for demand side users when they connect to the system, which is a barrier that limits a potential role for demand response in contributing to system operation activities. At a European level, this can lead to the same problems as caused by inadequately harmonised rules for generators.

2.3 Who is affected, in what ways, and to what extent?

Connected Parties - Generation and Consumption Units

The connected parties ensure the proper functioning of all services to the extent they have committed to, so that the TSOs and DSOs can use those services whenever needed. Generation (and some demand) units play an important role with their ability to provide ancillary services like reactive power or primary/secondary control power. DSOs and end-consumers should implement load shedding concepts which can be activated if necessary for preservation of system security

An example of the magnitude of the effects of system disturbances on these connected parties is given by the event of 4 November 2006 when the UCTE interconnected grid was affected by a serious incident originating from the North German transmission grid. This led to power supply disruptions for more than 15 million European households and a splitting of the UCTE synchronously interconnected network into three areas. Full resynchronisation of the UCTE system was completed 38 minutes after the splitting and the TSOs were able to re-establish a normal situation in all European countries in less than 2 hours. Whereas the incident itself is an issue of system operation, the follow-up effects caused by e.g. reconnecting of generators even though frequency was too high or tripping-off the grid of the large wind generators without keeping the predefined and required fault-ride through thresholds, certainly belong to the area of grid connection.

For demand customers, the impact of power disruptions results in loss of services which for some can have disastrous economic consequences. In the longer term, some consumers may invest in local generation units to provide backup power in the event of outage. For generation units the inability to access the network, or adverse impacts by tripping off from the system results in costs of non-delivering the generated energy to the customers and thus both, to economical loss in their business and loss of confidence and credibility in the market.

Transmission System Operators and Distribution System Operators

For TSOs and DSOs the costs of the problems identified above are experienced in two ways.

Firstly, the actual costs resulting from a disturbance, compensation to be paid to system users – generation and demand, and the costs of restoring the system after a fault.

Secondly, and particularly important in the longer term – costs in terms of investment will be required in preventative measures to mitigate further issues. If this is not properly coordinated or does not take account of the pan-European dimension as identified earlier, this response may be inefficient, or ineffective.

Regulators / ACER / Member States

According to Article 5 of Directive 72/2009/EC "*the regulatory authorities where Member States have so provided or Member States shall ensure that technical rules establishing the minimum technical design and operational requirements for the connection to the system of generating installations, distribution systems, directly connected consumers' equipment, interconnector circuits and direct lines are developed and made public. Those technical rules shall ensure the interoperability of systems and shall be objective and non-discriminatory*".

ACER may make appropriate recommendations towards achieving compatibility of those rules defined in Article 5 of Directive 72/2009/EC, where appropriate. Those rules shall be notified to the European Commission in accordance with Article 8 of Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services.

According to Directive 72/2009/EC (Art. 37 § 6.a.), the regulatory authorities shall be responsible for fixing or approving sufficiently in advance of their entry into force, at least the methodologies used to calculate or establish the terms and conditions for connection and access to national networks.

The regulators shall have the authority if necessary to require transmission system operators and distribution system operators to modify the terms and conditions as well as the procedures for grid connection (to remove any discriminatory practices).

Member States shall pay particular attention to ensuring objective, transparent and non-discriminatory implementation of a system of regulated Third Party Access (rTPA).

Manufacturers of generation equipment

To service the multitude of different connection requirements across the EU, equipment manufacturers are bearing increased costs to provide multiple variations on standard technology. The increased cost of tailoring standard equipment to the particular requirements of each national system is a cost ultimately borne by the electricity consumer through increased electricity prices.

2.4 How should the problem evolve, all things being equal? Should the EU act?

Without action, the grid connection problems identified above will increase in the future as system becomes more interconnected, with more intensified load flows in the grids, with higher volatility and in general as market integration evolves and the interdependencies between the different control areas grow. Furthermore, growing intermittent generation will further increase the pressure and demand for an appropriate and well-defined grid connection framework in the EU.

As a result, the disparity between national rules and standards for grid connection and the related procedures for compliance verification will further increase.

Such a development antagonises the desired direction of striving to a better coordinated grid development in Europe and better integration of the IEM. Supervision of such a development at European level will be nearly impossible. In addition, the spectrum of solutions to match the different requirements will need to broaden, resulting in higher costs for all parties concerned including the end users.

It is important to recall in this context, the recommendations concerning system operation from the ERGEG Final report on the 2006 disturbance [1], because these recommendations are also important from the perspective of grid connection:

- *"There is a need for an improved legal and regulatory framework to minimise the risk of future interruptions such as the 4th of November 2006.*

- *Measures by TSOs themselves to secure effective coordination and cooperation among each other are required. This must take place under appropriate regulatory oversight."*

The goal should be therefore to create a set of facts and procedures that is transparent to everybody concerned with transmission grid connection and to which all parties can commit. This process shall help bring concerned parties together for a reasonable exchange because their points of discussion are understandable and their importance is clear. For that, the EU shall provide the framework and point out issues of particular interest.

In the process of developing a harmonised and well-defined grid connection regime in the EU, the first positions on the vital topics of electricity grid connection should be addressed. Furthermore, positions on issues and topics interlinked with European rules of grid connection should be communicated, in order to allow market participants to assess the relevant issue. Finally, any relevant work done previously should be taken into account.

3 OBJECTIVES OF THE INITIATIVE

3.1 General objective

To address the problems set out in the previous section, the overarching objective of this initiative is to develop a harmonised electricity grid connection regime that will support optimal system operation and contribute to a sound technical evolution of the European electricity market and transmission network, through coordinated action from TSOs, DSOs and grid users.

In achieving this, the initiative will contribute to maintaining security of supply, supporting the completion and functioning of the internal market in electricity and cross-border trade including delivering benefits to the customers and facilitating the targets for penetration of renewable generation.

This overarching objective will be delivered through a number of specific objectives focused on various elements of grid connection.

Moreover the objective of the initiative is to provide clarity on the relationship between national and European grid codes. A standardised connection regime should set out the intended relationship between national codes and the European network codes on grid connection. It should also seek to establish the appropriate relationship between the network code(s) on grid connection and other possible areas to be covered by European network codes, such as the framework guidelines and network codes on third party access, system operation and electricity balancing markets integration.

3.2 Specific objectives

<u>Objective #1: To devise standardised minimum requirements for connection of grid users</u>

The problem definition clearly identifies a need for harmonised responses from system users (generation and demand) across synchronous areas, to avoid or at least minimise the impact of widespread system faults and ensure secure and optimal system operation.

The aim is hence to establish an appropriate minimum degree of standardisation of connection requirements applicable across all synchronous areas that maintains the existing standards of security and quality of supply. This should ensure equitable treatment in the connection of generators and consumers to the extent that these rules may impact cross-border trade and system security.

All users connecting to the grid should comply with all relevant electrical engineering regulations and standards and, in addition, a harmonised regime should seek to provide standardised guidance on specific areas relevant to the problems identified (e.g. uncontrolled disconnection and reconnection).

Key areas can be identified where standardisation of minimum requirements is needed to contribute to secure system operation:

i) frequency and voltage ranges;

ii) requirements for reactive power;
iii) load-frequency control related issues;
iv) fault ride through capability;
v) balancing capabilities and provision of ancillary services;
vi) minimum conditions for (re)connection to the grid in disturbed/critical operating state.

Transparency in the connection requirements for generation and demand is also important to give each system operator sufficient information necessary to better manage the different types of generation and demand connected on the transmission and distribution networks. Therefore, the future regime for grid connection will also identify mandatory and optional capabilities and services (from those identified above).

As identified earlier, variance in enforceability of connection requirements also contributes to system instability. To address this, appropriate measures should be provided to ensure TSOs (and DSOs) can require and verify fulfilment of the approved terms and conditions for grid connection, again on a standardised basis across a synchronous area.

It is further important to evaluate an impact of applying the harmonised grid connection rules also to the existing (already connected) grid users. Whereas the grid connection rules need to be applied in a harmonised way also on the existing grid users, due to the existing grid users' rights and obligations within the scope of their present grid connection, sometimes transition periods will be needed to fulfil that. Moreover, in some cases the application on the existing grid users might even be unfeasible for the time being, at least unless there are some changes to the connected grid users' facility. The consequences of such non-applicability need to be assessed and communicated accordingly to all affected actors (grid operators, generators, regulators, etc.).

<u>Objective #2: To promote (real-time and other) exchange of information between parties and improved coordination</u>

Real-time information on the status of grid users and on the operating parameters of System Operators (SOs) is an essential requirement for coordinated operation. The absence of this data and of data exchange increases the impact of faults, prolongs damaging system operation issues and prevents SOs from accessing services in an optimal and efficient manner. Enabling close to real-time exchange of information between TSOs, generation and distributed generation connected to the distribution network is therefore an important specific objective of this initiative.

The proposed grid connection regime will find an appropriate solution to enable communication at every level necessary and will provide the means for bi-directional information exchange where necessary (i.e. with grid users passing information upwards to the appropriate system operators, and vice versa). To deliver an effective information exchange solution, confidentiality and the legal basis for sharing of information between parties and between national systems must also be addressed.

The connection regime should evaluate the impact of information provision and coordination in the following instances: TSO to TSO (overarching data exchange and coordination between national systems), TSO to DSO (coordination of system operation within national systems) and TSO (and DSO) to grid users (coordination of system operation, provision of balancing services, etc.). In each case it should be clearly identified and justified, what type of information is required, how often and when that information should be provided. This may be a one-off transfer of data (e.g. on connection), or ongoing provision of operational data. As elaborated in the problem definition, in many instances real-time information is not currently available. The initiative will therefore have to evaluate the impact of minimum standards for collection and provision of real-time data from grid users and SOs.

Objective #3: To establish an appropriate connection regime for specific grid users

The initiative aims to standardise minimum connection requirements for grid users across synchronous areas. In some instances there may be a case for a specialised (supplementary) connection requirement to address specific grid users or technologies, of which three are identified here, that relate specifically to the system stability problem identified earlier:

i) large-scale intermittent generation;
ii) distributed generation;
iii) demand response.

Large-scale intermittent Generation

The high and increasing penetration of intermittent generation has been identified as a clear driver of the system stability challenges experienced across synchronous system areas. Because of the specific characteristics of intermittent generation that differentiate it from conventional (thermal or hydro generation with low or almost no intermittent character) generation, the initiative will explore the need for and impact of a specific standardised connection code for large-scale intermittent generation on maintaining system security.

Distributed generation

The expected increase in distributed generation is contributing to the system stability challenges as set out earlier. The initiative will explore alternative responses for a specific grid connection applicable to distributed generation to overcome its negative impact on system stability.

Demand response

The role of demand response in contributing to system stability is hampered by a lack of attention in connection requirements. Within that context and in the sense of supporting the balancing capabilities of the demand response, the initiative will explore the benefits of specific standardised requirements for demand customers in the provision of response services.

4 POLICY OPTIONS AND THEIR ASSESSMENT

4.1 Policy options and delivery mechanisms

For each of the identified main problem areas that require action and in relation to the objectives defined in preceding chapters, most suitable responses are described and assessed, thus proposing the preferred alternative.

From a high level perspective, strategies range from a so-called "Option 0" (i.e. *status quo* is maintained with no action at the EU level) to a comprehensive compound of framework guidelines and binding network codes at EU level; in between, national and regional scope is also deemed possible: different problems may call for different approaches.

The way a certain option is put into effect relies on a number of dimensions to be considered regarding policy assessment. Different combinations of mechanisms can be considered alongside a particular policy option to achieve the final result; impact assessment should underline where a determined mechanism would have a significant role in driving a policy option's impact.

It is also worth highlighting that:

- Network codes to be prepared by the ENTSO for Electricity are not intended to replace the necessary national network codes for non-cross-border issues[5];
- Network codes shall further focus mainly on the cross-border, IEM related and market integration issues and shall be without prejudice to the Member States' right to establish national network codes which do not affect cross-border trade[6].

4.2 Evaluation criteria and main stakeholders

According to the European Commission Impact Assessment (IA) guidelines [7], the screening process should consider the main policy options and then eliminate the not-applicable ones immediately.

Moreover, for the policies considered (including also *Option 0*), it is important to consider all the relevant positive and negative impacts alongside each other, regardless of whether they are expressed in qualitative, quantitative or monetary terms.

Thus a screening process allows obtaining a short list of the most promising option(s) whose impact assessment can be further analysed. Policy options are gauged for their suitability in meeting objectives of each area against these three high level criteria:

[5] (7) Regulation (EC) No 714/2009
[6] Article 8.7 Regulation (EC) No 714/2009

- **Effectiveness**: The extent to which options can be expected to achieve the objectives of the proposal;
- **Efficiency**: The extent to which options can be expected to achieve the objectives for a given level of resources with least cost and highest benefit (cost-effectiveness);
- **Consistency**: The extent to which options are likely (or not) to limit trade-offs across the economic, social and environmental domain.

Policy options scoring high in the screening process are subject to a cost-benefit analysis for diverse parties affected, based on discussions and findings from references [1] through [4]. Although a quantitative approach is not straightforward at this stage, a differentiated view on all influencing and influenced factors is provided.

Key stakeholders groups considered in this IIA are:

- **System Operators** (both TSOs and DSOs);
- **Generators**: Either fossil-fired or RES (Renewable Energy Sources) - based; conventional or distributed;
- **Consumers**: End-users from large industries to domestic customers; and
- **Others**: Equipment manufacturers, facility constructors, project developers...

4.3 Assessment of impacts

An impact assessment of policy options by action area and associated delivery mechanisms aims at clarifying the probability of achieving the identified objectives, i.e. the likelihood to solve problems previously detected, given a number of underlying problems. It helps to predict policies' consequences, too – both intended and unintended.

This exercise allows gathering information about likely impacts on stakeholders and against the three main criteria above, as well as potential trade-offs and synergies. It's also useful to identify enhancing measures, i.e. the ways to 'fine-tune' a policy option.

In this context, a detailed in-depth cost-benefit analysis is particularly important, rooted in the results of the public workshop held on 16 April 2010 (summary of the discussions, proposed changes and suggestions is provided at the European regulators' webpage www.energy-regulators.eu. Whereas this provides a good qualitative view to orientate a sound decision-making process, a fully fledged quantification might only be feasible ex-post, within implementation of the Codes' scope.

Improved grid connection requirements would improve system security condition and thus avoid costs derived from emergency situations. As long as implementation of 3rd Package is still pending, it is not foreseeable how key issues will develop, but they will be interrelated; forthcoming guidelines and codes will influence each other.

4.4 Policy options and delivery mechanisms for achieving the objectives

In the following, different policy options and related delivery mechanisms are assessed in terms of their suitability to reach the objectives defined in Chapter 3, which in turn are required for resolving problems identified in Chapter 2.

4.4.1 Objective #1: To devise standardised minimum requirements for connection for grid users

4.4.1.1 What is the issue?

Diverging requisites imposed on generators result in higher manufacturing costs and uncoordinated trip / (re)connection specifications. Diverse system operation parameters turn into an absence of automatic management features and possible misinterpretation or inaccuracy of rules and potential increase of balancing power needs. Insufficient or non-standardised requirements for the connection of customers might impose additional costs on them too. Moreover, it is important to distinguish those grid connection requirements which will have to be applied in a harmonised way also on the existing (already connected) grid users, as well as to assess a consequence of not doing so.

4.4.1.2 What are the dimensions considered in order to regard the policy assessment?

The dimensions can be summarised as below:

(i) *Application of codes to new and / or existing units*

Which harmonised requirement cannot be applied only to new units joining the system but must also address the existing units - either immediately or after some transition period? What are the trade-offs between efficacy of the harmonisation solution and total costs of implementation; including consideration of costs for new and existing units, manufacturers, etc.

(ii) *Level of implementation*

From SO level, going on to general regulatory directions or legislation within national jurisdictions, and finally pan-European scope, considerations such as how likely options are to be challenged or significantly modified, may recommend the preferable implementation level.

(iii) *Type of user of the grid connection code(s)*

Grid connection code(s) to be developed might be e.g. fully or partially relevant only to generators or may also apply to loads; they could also consider the size of the user, and the voltage level at which it is connected (e.g. transmission or distribution).

(iv) *Specificity of grid codes*

Closely linked to the previous point - whereas the general framework for grid connection will presumably cover generic grid connection provisions for all grid users

- either a highly detailed code providing specific guidance for individual user types, or a single, high level code applicable to all types of grid users (with annexes for specific cases if needed) might be created.

(v) Technical scope / remit of guidance

The technical scope could be universal to cover the full remit of grid connection codes, or limited to cover specific topics and situations with particular relevance to the objectives of the initiative. In each case, the guidance provided could be highly detailed or of a more general, high-level content.

4.4.1.3 What are the policy options?

The policy options to deliver this objective are considered below:

1.A. No action at the EU level and no standardisation of grid connection requirements within a common European framework and technical detailed codes (*Option 0*);

1.B. Standardisation of grid connection requirements at Member State level, bilateral agreements among the MS;

1.C. Standardisation of grid connection requirements at the regional (synchronous area) level, possible agreement within or between the regions beyond that;

1.D. EU-wide harmonised grid connection requirements, detailed technical codes.

4.4.1.4 What is the impact of these policy options?

Recalling the problems identified and the sum of all general and specific objectives in Chapter 3, it follows that the *Option 0* (1.A above) will not meet any of the defined criteria (effectiveness, efficiency and consistency) and can therefore be rejected at the beginning. Indeed, for the first framework guidelines, grid connection was identified as an area where standardisation in requirements is needed so as to prevent especially emergency situations such as uncoordinated trip / reconnection. Therefore, “no action” would not solve the risk identified, especially in the context of increased interconnection capacity and increasing (more efficient) utilisation of this cross-border capacity.

Assuming that some degree of EU-guidance is required, closer consideration should be given to the desired trade-off between scope and depth of content desired: the wider the scope, the shorter the number of parameters to be successfully included.

An EU-wide framework and detailed technical code could be underpinned by a handful of critical features whose ranges of reference are probably already shared by many of the jurisdictions involved; a narrower scope might make possible to include an increased number of requirements and be more detailed.

Effectiveness[7] is the key criteria to select the most suitable policy and its implementation at adequate level: the focus should be ambitious enough to cope with all pursued targets:

- From generators' and manufacturers' perspective, the freedom to circulate goods would be a void concept if the market where those goods are sold was already partially fragmented in an artificial way because of inconsistent technical demanded features.
- From TSOs' perspective, operational trouble induced by unexpected and eventually uncoordinated units' response poses potentially severe added risks.
- For end-users, an active policy results in less expensive supply, via reduced producers' CapEx and OpEx, as well as lowering balancing services' bill.

Option 1.B) may be effective in poorly interconnected systems, i.e. bilateral agreements between islands (or peninsulas) and the countries that link them to the rest of the continent. However, this solution would pass inconsistencies in standards from peripheral countries to "central countries". Therefore, option 1.B) presents drawbacks in terms of effectiveness.

Effectiveness needs to be balanced with proportionality so as to achieve a good level of efficiency.

Moreover, efficiency should be granted at least in the medium and long term: future, long-lasting savings in equipment manufacturing and ancillary services provision should be worth up-front harmonisation costs and considerable administrative burden, resting mainly upon operators' shoulders, in the short term. The overall objective of the Internal Electricity Market is partly justified by efficiency gains (arising from competition). An EU internal borderless market (not only for energy but also for equipment manufacturing) has the potential to boost competitiveness in the European industry, both within the EU and towards the rest of the world. From that perspective, option 1.D) is stronger.

Consistency should be granted as long as good signals are given to market players in a competitive EU energy market, provided that proportionality principle is preserved.

Moreover, consistency should be granted also in terms of compliance with grid connection requirements by all grid users. On one hand, imposing (now harmonised) requirements on the existing users may lead e.g. to additional costs, organisational changes or other effects on them. On the other hand, however, if the existing, already connected users are not compliant with the mandatory requirements, this would jeopardise the objectives of the harmonised grid connection rules.

Finally, it would be wise to select a policy option that will pertain to the main objective, factual features (a nuts-and-bolts approach), without a case-by-case, deeper specification, and only for installed capacities in excess of e.g. 100 MW, in a uniform way across Europe. If standardisation is focused only on really critical points, it would not be fair (not consistent) to allow different burdens to be put on the involved parties (namely, grid operators and

[7] Effectiveness concerning both new and existing users.

generators) depending on political (not technical) borders. This reasoning gives support to options 1.C) and 1.D).

Taking the above elaboration into account yields that the Option 1.D) prevails over the remaining two Options - 1.B) and 1.C) in terms of all relevant criteria:

- Effectiveness of the solution, whereby the threatening market fragmentation and adverse effect of diverging grid conditions to grid users will be prevented by a common EU framework; moreover, the SOs operational challenges (both those of TSOs but also of the DSOs, where they are concerned either as the TSO grid user or as the SO to which e.g. distributed generation is connected) will be tackled in an appropriate way;

- Efficiency of solution, which when designed correctly will address all the cross-border relevant issues, but not go into too many details at the national or regional level which cannot be harmonised within the reasonable timeframe;

- Consistency of the solution, if a sufficient level of detail is taken into account in all relevant technical issues and implemented in the respective codes to apply to all of the EU.

Summarising, Option 1.D) to develop a common EU wide framework with minimum standard harmonised grid connection requirements applicable for all grid users and with relevant detailed codes to follow this framework, should be regarded as the preferred policy option here.

4.4.2 Objective #2: To promote (real-time and other) exchange of information between parties and improved coordination

4.4.2.1 What is the issue?

Recalling the description of this objective in Chapter 3, it follows that coordination between different interlocutors within a variety of grid connection procedures (TSO-TSO, TSO-DSO, TSO-generator, DSO-generator, DSO-consumer, etc.) is crucial for future system resilience – this is independent of any policy option selected to address the other problems and objectives identified. Moreover, transparency (understood as due information sharing and availability) is a cornerstone of coordination.

Under this broader coordination ‘umbrella’, more specific objectives aim at the standardisation and adequacy of operational aspects included as a relevant part of contractual compromises among aforementioned actors.

Where lack of coordination is only attributable to absence of compatible formats and protocols, a complete EU-wide harmonisation would seem the most sensible policy. However, many problems derive from deep-seated relationship schemes establishing varying rights and obligations for different market players from one country to another.

4.4.2.2 What are the policy options? What is their impact?

2.A. No action on exchange of information and coordination (*Option 0*).

Bearing the above in mind and taking account of the extreme importance of coordination and exchange of information in all relevant aspects of cross-border grid connection issues, it follows that *Option 0* is not the right policy option and that no action at EU level will lead to a deteriorated situation in the future. The problems identified in Chapter 2 require improved exchange of information between the SOs and grid users even if a "zero option" is chosen for all other objectives.

2.B. Introduction of specific framework for improved exchange of information and coordination, possibly at different level of details for the EU and for regions / MS.

A prescription of an all-encompassing binding European code might seem very ambitious in the short run and policies to be considered for that would preferably encompass a regional scope, at least at the beginning. A set of common basic files and brief reports should nevertheless be defined for disclosure purposes only, following simple, shared templates.

Thus, in terms of data exchange European guidance provisions and regional detailed requirements in the related codes need to be complemented with the necessary agreements between grid operators and grid customers.

When it comes to TSO-TSO relationship, a higher-profile approach might be considered because of the further reach and eminent cross-border features of such data exchange. Here interaction and possible overlaps with the capacity allocation and congestion management FG might be observed and need to be resolved accordingly.

Efficiency is the key criteria to select the proper policy option: once sound contractual basis is laid down and robust enough, transparent information sharing is granted and widely spread within a region or synchronous area, additional benefits derived from an expanded EU-wide observance will certainly exceed marginal benefits.

Effectiveness must also be granted as allowing different players' profiles to attain their respective targets:

- From TSOs' and DSOs' perspective, greater coordination and standardised information sharing translates into lower transactional costs and more sensible decision-making processes.
- From generators' and consumers' perspective, greater transparency reinforces unbundling provisions and eases the launch and monitoring of occasionally resource and time-consuming grid connection procedures.
- Administrations and regulatory authorities would also benefit from dealing with more uniform contractual clauses and data sets across different MSs without the recourse to potential simplifications or approximations.

Consistency will also have to be granted since coordination enhancement doesn't interfere nor demand for trade-offs regarding pure economic or environmental domain.

As has been said in paragraph above and supported by the assumption that *Option 0* is not an appropriate one and with a clear understanding that significant improvement of information, communication and coordination in all cross-border relevant aspects of grid connection is essential, the elements of the adequate policy option (2.B*)* are summarised below:

- Definition and implementation of necessary transparency and mutual exchange of information by these actors;
- Standardisation and adequacy of operational aspects included as a relevant part of contractual arrangements among aforementioned actors;
- Compatible formats and protocols in the issues where a complete EU-wide harmonisation resolves the underlying problem – for the sake of efficiency and effectiveness, these should mainly be implemented at regional level;
- A set of common basic files and brief reports might further be defined for disclosure purposes, following simple, shared templates;
- European guidance provisions and regional detailed requirements in the related codes need to be complemented with the necessary agreements between grid operators and grid customers at the regional level;
- Especially at the level of TSO-TSO interaction, a higher-profile and more specified approach is needed with a sufficient level of detail in the related code, because of the further reach and eminent cross-border features of such data interexchange. Interaction and possible overlaps with a congestion management FG might be observed and need to be resolved accordingly;

4.4.3 Objective #3-1: To establish an appropriate connection regime for specific grid users – large-scale intermittent generation

4.4.3.1 What is the issue?

In addition to considerations made in relation to Objective #1 about different requirements on generators, increasing penetration of large-scale intermittent generation poses further challenges to Europe-wide system operation, despite refinement in forecasting and clustering techniques. Its specificities require an adequate treatment as regards grid connection issues.

Intermittent generation can hardly be modulated alongside system load curve, the locations of it are often irregularly distributed, usually far away from significant loads (even from the shore), and therefore prone to suffer bottlenecks and induce energy spills. Furthermore, older intermittent generation may not have low voltage ride-through capabilities.

When great amounts of intermittent power are injected in quasi-isolated systems poor in natural-born regulating technologies (typically large hydro, pump storage and open cycle gas-fired turbines), cautious measures must be taken for safe large-scale intermittent power integration.

Even in densely meshed networks, massive, irregular intermittent power intakes may induce big scale loop-flows difficult to anticipate, which occasionally make previously well-known, easily predictable cross-border flows extremely volatile.

Moreover, large-scale wind power is nowadays by far the most firmly established generation on the basis of RES on European soil and sea and is essential for the EU to reach the ambitious 2020 targets.

The objective of the initiative is hence to establish an appropriate connection regime for large-scale intermittent generation that mitigates the specific problems caused with reference to system stability, but recognises the contribution that these technologies are required to make towards renewable targets.

4.4.3.2 What are the policy options?

The policy options to deliver this objective are considered below:

3-1.A. No specific requirements for large-scale intermittent generation (*Option 0*). The measures taken under Objective #1 (to standardise minimum requirements for all grid users) would be considered sufficient to resolve the problems posed by intermittent generation.

3-1.B. Standardised grid connection requirements for large-scale intermittent generation. A standardised but generic approach to address the specific issues caused by intermittent generation of all kinds. This would be additional to the standardised requirements for all grid users.

3-1.C. Standardised grid connection requirements for specific intermittent generation technologies. Standardised requirements should be devised for particular technologies, including e.g. wind, hydro, PV, etc.

4.4.3.3 What is the impact of these policy options?

Policy option 3-1.A) with no specific requirements for large-scale intermittent generation is a rather straight-forward one in terms of non-discriminatory treatment of all grid users. This would also correspond to the generally accepted rules and principles of good legislation and regulation, where any special treatment of a grid user should in principle be avoided.

However, considering the mentioned significance of large-scale intermittent generation (wind), the technical challenges of ensuring common interaction of large wind farms with the electricity grids in case of disturbances (tripping / reconnection) and of balancing the intermittency, this policy option raises the question of effectiveness. If no specific requirements are elaborated in the wind connection framework and detailed technical rules, we might face the worsening of present situation described in Chapter 2, as much more new wind generation is built and connected to the European grids. It follows hence that the efficiency of this option in relation to massive growth and integration of large-scale intermittent generation is insufficient.

Finally, any specific requirements for the large-scale intermittent generation can and should - if needed – be designed so that any discrimination is avoided but at the same time that all relevant technical specificities are taken into account. These requirements should also be consistent with the security of the system, avoiding problems with wind power in critical situations (e.g. wind generators should keep functioning under reasonably defined voltage dips). This is why this policy option is not considered fully appropriate for the delivery of the mentioned Objective #3 in terms of large intermittent generation.

Policy option 3-1.B) with standardised but generic requirements for large-scale intermittent generation would encompass different technologies / energy sources, including wind, but also e.g. solar thermal power when relevant. If designed properly in terms of non-discrimination and equal treatment and if addressing only the technical issues of balancing and behaviour in case of tripping / reconnection, this would be an effective way to address all kinds of large-scale intermittent generation in a non-discriminatory way. While being wider than the previous option, it can still preserve efficiency, presuming the depth and level of detail of the related generic code for large-scale intermittent generation is sufficient. Finally, if building upon the general principles of standardised requirements for all grid users, this option would also deliver a high consistency with the overall grid connection framework.

This is why this option is considered to be well suited for achieving Objective #3 in terms of large intermittent generation. Furthermore, its implementation in the different national frameworks would be very simple. In a few words, this option provides for an effective enough, efficient, consistent and non-discriminatory framework.

Policy option 3-1.C) with standardised detailed requirements for all kinds of intermittent generation would presumably provide for the highest level of technical effectiveness. However, in terms of efficiency of the solution and especially in terms of how many details and different national specificities would be affected, this would require a very lengthy and – from the perspective of costs / benefits for all grid users – questionable development. Finally, with many different specific standards (codes) for each of the different technologies of intermittent generation, consistency of the approach and keeping track of all necessary changes in the future evolution would most probably be a very complex – if not unfeasible – task to accomplish.

For those reasons, this policy option is not considered as meeting the criteria, most notably the criteria of consistency. It is important, however, to mention in this context, that time frames where intermittent generation becomes more reliably foreseeable belong to intraday, and the closer we move towards real-time, the more important local circumstances become: shorter times, wider subsidiarity, and lesser harmonisation. Thus, a binding pan-European framework and code for such a level of detail seems impracticable, at least, at this stage.

Therefore, although this option ensures maximum effectiveness, its high cost and the difficulties imposed to large-scale intermittent generation, is less feasible than the preferred option 3-1.B) and raises concerns related to proportionality and non-discrimination principles.

4.4.4 Objective #3-2: To establish an appropriate connection regime for specific grid users – distributed generation

4.4.4.1 What is the issue?

Power network design and management evolved for decades under the assumption of a cascade-like scheme, where a few large producers were positioned at the top of the supply chain and electricity flowed down towards many passive consumers, few of which might be able to modulate their load following a well-known pattern.

This picture no longer resembles reality, since now small to medium CHP (Combined Heat and Power) and RES facilities account for a relevant share of energy mix and build up significantly decentralised generation park injecting power where only draining it was expected before.

What is more, an increasing number of smaller consumers, even households, recently equipped also with micro-generation facilities, are developing increasing price sensitivity in the light of retailing market sophistication, and the concept of "grid parity" may lead to dramatic changes in power flow hourly patterns.

In this context, a preliminary assessment suggests that dealing appropriately with distributed generation cannot be achieved by "no EU-action" - a younger concept is needed instead, and while we are aiming at the first European energy regulatory framework, it would be a pity to face new problems with old tools. This is why it is necessary to face the problem right now, at this point, and solve this complex question.

On the other hand, a part of the smallest distributed generators are, first of all, consumers, and the way they are treated from DSO's perspective has much to do with the (following) demand response topic.

Small, scattered generation is also an important driver for distribution business: it may raise costs, in terms of increased investment and technical and equipment, and also induce gains because of loss reduction and lower load factors.

Both end-users' and distributors' regulation have a profound national component that cannot be ignored; thus an intermediate path should be followed.

The fact that many of the components and facilities needed are already subject to a remarkable degree of standardisation merely due to industrial and commercial efficiency reasons, should bias the approach adopted in direction to increasing harmonisation, if not at European, at least in a supranational environment.

Moreover, intermittency is another characteristics of distributed generation, depending on the primary energy source used (e.g. PV, natural gas, bio-gas, bio-mass, etc.)

The objective of the initiative is hence to establish also an appropriate connection regime for distributed generation, that mitigates the specific problems mentioned, recognises the importance and contribution of distributed generation towards 2020 targets and the need for non-discriminatory treatment of all grid users.

4.4.4.2 What are the policy options?

The policy options to deliver this objective are considered below:

3-2.A. Requirements for distributed generation within the scope of standard requirements for all grid users (*Option 0*). The measures taken under Objective #1 (to standardise minimum requirements for all grid users) are sufficient to resolve the problems posed by distributed generation

3-2.B. Standardised grid connection requirements for distributed generation. A standardised but generic approach is needed to address the specific issues caused by distributed generation. This would be additional to the standardised requirements for all grid users.

3-2.C. Standardised grid connection requirements for specific generation technologies. Standardised requirements should be devised for particular technologies, including e.g. conventional thermal, hydro, wind, PV, etc.

4.4.4.3 What is the impact of these policy options?

Policy option 3-2.A) with no specific requirements for distributed generation is also a rather straight-forward one in terms of non-discriminatory treatment of all grid users. However, considering the criteria for impact assessment (effectiveness, efficiency, consistency) this option resembles the option 3-1.A) where no specific requirements for large-scale intermittent generation would be foreseen – even though the scale of the challenges and the urgency in solving the grid connection issues for distributed generation is to a certain extent lower than in the case of large intermittent generation, the rapidly growing portion of distributed generation in the overall generation structure in Europe calls for an adequate approach here too.

This is why this policy option is not considered fully appropriate for the delivery of the mentioned Objective #3 in terms of distributed generation.

Policy option 3-2.B) with standardised but generic requirements for distributed generation, building upon the standard requirements for all grid users and extending those where necessary would be an effective one if designed with a sufficient level of detail and depth. Moreover, if designed properly in terms of non-discrimination and equal treatment and if addressing only the technical issues, mainly concerning bi-directional flows and changed patterns of flows between transmission and distribution, this would be an effective way to address distributed generation connection in an appropriate way.

This is why this option is considered to be well suited for achieving Objective #3 in terms of distributed generation.

Policy option 3-2.C) with standardised detailed requirements for all kinds of different generation technologies can – similarly as in the case of large-scale intermittent generation – be considered inadequate mainly due to the low efficiency (many very detailed and lengthy procedures and components to establish the related codes) and because of the difficult maintaining of consistency with other elements of the future grid connection framework.

4.4.5 Objective #3-3: To establish an appropriate connection regime for specific grid users – demand response

4.4.5.1 What is the issue?

As regards demand side management / demand response[8], the problem is not as much the differences among national regulations as the practical absence of such regulations. Those MSs with such provisions concentrate mainly on larger industrial consumers with modulating capabilities or even willing to suspend supply under certain circumstances.

The domestic / SMEs (Small and Medium-sized Enterprises) market will have an important role to play in this regard, subject to the massive roll out of smart metering devices that allow for an active interaction through traditional suppliers or Load Serving Entities (Balance Responsible Parties).

Whereas to make full use of the demand response it is essential to take into account the ambitious policy options, binding supra-national enforcement seems impracticable unless countries involved already share most of their retail market structure.

A partial voluntary methodology is suggested, for experience shows that MSs are reluctant to give up a high degree of subsidiarity when it comes to end-users treatment, more so the smaller they are. EU monitoring should avoid divergences or inconsistencies which might clash with the development of a true Internal *retail* Energy Market.

This should be interpreted as “evolution instead revolution”, building on existing regulatory framework so as to leverage it, keeping in mind that cross-border dimension seems less relevant here.

Efficiency is the key criteria to select the appropriate policy option here: gains derived from a more active demand side management may reach a maximum when confronted with transactional costs induced by progressive assimilation of historically different retailing schemes.

Effectiveness would be granted as long as different players’ expectations can be depicted and agreed:

- From TSOs’ and DSOs’ perspective, better demand response is an opportunity to beat yardstick competition targets for balancing services costs and allotted loss rates.
- From consumers’ perspective, greater response abilities may reduce electricity bill and diminish environmental impact.
- Administrations and regulatory authorities would more easily meet already set ambitious objectives for energy intensity, peak shaving and power saving.

[8] Both terms standing here for a market-oriented, compensated participation of demand, but not a forced disconnection in the form of load-shedding in case of emergency or critical situations in the grid.

Consistency is granted since provided proportionality in equipment investment (e.g. smart meters, consumption management, electric vehicles recharge, etc.) is confronted with feasible saving targets.

Recalling the problem definition and the related Objective #3, there is a need for harmonised responses from system users (generation and demand) across synchronous areas, to avoid or at least minimise the impact of widespread system faults and ensure secure and optimal system operation, to ensure equitable treatment in the connection of generators and consumers.

Moreover, treatment of demand response as such has not been a subject of many specific grid code elements even at the national level of the MS. Whereas this was acceptable in the past, with the present need to support achievement of the 2020 targets and even more, to balance the future massive intermittent generation, active demand side participation in the market appears to be unavoidable.

Compliance of demand response grid users with all the standard requirements applicable for all grid users is an important condition. Moreover, specificities of the demand response grid users need to be addressed including coordination, organisation and market related issues.

Moreover, transparency in the connection requirements for demand response is essential for the SOs to be able to manage and integrate the demand response services in the network operations, most notable in relation to balancing of intermittent generation.

The objective of the initiative should hence also encompass the establishment of the appropriate connection regimes for the demand response users, be it within the scope of the standard general requirements for all grid users or within a separated framework.

4.4.5.2 What are the policy options?

The policy options to deliver this objective are considered below:

3-3.A. <u>No requirements for demand response grid users (*Option 0*).</u> There would be no specific requirements for the demand response grid users.

3-3.B. <u>Specific grid connection requirements for demand response grid users</u>. A standardised but generic approach is needed to address the specific issues caused by demand response. This would be additional (or within the scope) to the standardised requirements for all grid users.

4.4.5.3 What is the impact of these policy options?

Policy option 3-3.A) with no specific requirements for demand response appears sufficient at present, where balancing of intermittent generation is still manageable with the existing resources. However, considering the future trend and the massive growth of intermittency and the need for balancing in the future transmission (and distribution) grids, there is a need to address the specific issues of demand response accordingly. This is why this “zero-option” is not considered appropriate for the delivery of the mentioned Objective #3 in terms of demand response.

Policy option 3-3.B) with standardised but generic requirements for demand response would meet the criteria of consistency, as it has been postulated before that there should be equal treatment of all kinds of grid users, but taking into account their specific characteristics and needs in terms of grid connection.

Moreover, in the future electricity market organisation and with growing participation demand response for system balancing, a number of technical requirements will need to be considered for those users in terms of their connection to the grid. This is why this option is considered to be well suited for achieving the Objective #3 in terms of demand response.

4.5 Preferred policy options

Grid connection issues are universally appealing: they affect all kinds of stakeholders and the multiple relationships between them. Therefore, the policy options chosen should be flexible and expressed as a combination of complementary alternatives, among which most suitable one may be selected depending on the topic and parties it deals with.

In this regard, the Objectives identified in Chapter 3 have been matched above with the possible policy options to achieve them and the impacts of these policy options evaluated in terms of effectiveness, efficiency and consistency.

The preferred overall policy option for the future grid connection regime in the EU is therefore expressed in the following terms:

1) In order to achieve Objective #1, the EU wide standardised minimum set of grid connection requirements and detailed technical codes shall be developed, that apply to all grid users;

2) For Objective #2, a specific framework for improved exchange of information and coordination is necessary, possibly at different level of details for the EU and for regions / MS.

3) In line with the Objective #3-1, standardised grid connection requirements for large-scale intermittent generation are needed, with standardised but generic approach to address the specific issues caused by intermittent generation of all kinds. This would be an additional set of requirements, to the standardised requirements for all grid users.

4) Objective #3-2, to establish an appropriate connection regime for specific grid users – distributed generation – requires standardised grid connection requirements for distributed generation.

5) Within the Objective #3-3, to establish an appropriate connection regime demand response, specific grid connection requirements for demand response grid users should be developed complementary to the general minimum standards for all users, especially taking into account future demand side participation in balancing and providing respective services to the SOs.

Within this scope and contents, the framework guidelines for grid connection shall be developed, to be followed by the respective detailed network codes.

Moving to jurisdiction attribution, system operators should be entitled to impose the fulfilment of, and monitor the compliance with, the defined connection requirements. Their authority in this field should be assured in the same terms across all of the EU territory, as a steady, homogeneous reference,

A mandatory enforcement is suggested further in order to ensure compliance with the framework guidelines and codes, since the experiences with a voluntary approach suggest that it will not deliver results, at least not in a reasonable timeframe.

Whereas the above described preferred policy option(s) will require extensive adaptations of the existing framework in some cases, the level of such adaptations must be carefully governed by the overarching goal to address only cross-border relevant grid connection issues.

Furthermore, the main objective of the framework guidelines is to highlight **which** emerging questions/problems with regard to grid connection issues should be solved, leaving the approaches on **how** to solve them to the related network code(s).

Nevertheless, the framework guidelines should be detailed enough to cover all necessary issues on own merits, but leaving space for detailed and customised arrangements where applicable to be defined in the network code(s).

Here, a clear role for the European Commission is to enforce common codes, standards and procedures. The subject of this initial impact assessment and the framework guidelines for grid connection is therefore being an essential contribution towards that direction.

ANNEX 1 – Glossary and Abbreviations

Term	Definition
ACER	Agency for Cooperation of Energy Regulators
CHP	Combined Heat and Power
DSO	Distribution System Operator
ENTSO-E	European Network of Transmission System Operators – Electricity
ERGEG	European Regulators Group for Electricity and Gas
FG	Framework Guidelines
IA	Impact Assessment
IEM	Internal Electricity Market
IIA	Initial Impact Assessment
ITC	Inter-TSO Compensation
MS	Member STate
PV	Photovoltaic generation
RES	Renewable Energy Sources
rTPA	regulated Third Party Access
SME	Small and Medium-sized Enterprise
TSO	Transmission System Operator
TT	Transmission Tarification

ANNEX 2 – Mandate for ERGEG to Develop FG for Grid Connection

In a letter of 26 March 2010, from the Director of the European Commission DG Energy to the ERGEG President, the European Commission invited ERGEG to submit the FG for Grid Connection:

"… In recognition of the importance of ensuring the effective application of the institutional framework established by the Third Package for the establishment for a European integrated energy market, there is general agreement among stakeholders that it is appropriate to begin work on the development of framework guidelines and the network codes as soon as possible.

In this context, ERGEG has declared its readiness to undertake the role envisaged for the new Agency for the Co-operation of Energy Regulators in anticipation of the application of the Third Package rules, in particular Agency Regulation (EC) 713/2009. Similarly ENTSO-E has indicated that it is ready to undertake the functions assigned to the ENTSO for Electricity to be formally established in accordance with Electricity Regulation 714/2009.

On this basis, we reached agreement at the last meeting of the Florence Forum to begin work on pilot framework guidelines and network codes on rules governing connection to the transmission system in electricity, on rules governing capacity allocation and congestion management and capacity calculation and rules governing security standards and system operation. This work will serve two functions: firstly, stakeholders will benefit from the experience of working with the new processes before their actual applicability, supporting the effective implementation of the third package when all the new bodies have been formally established, secondly this will enable substantial progress to be made in this important area, supporting the integration of renewable energy and helping achieve the policy aims set out in the Energy Policy for Europe and the Strategic Energy Review.

I therefore invite ERGEG to assume the role assigned to the Agency under Article 6 (2) of the Electricity Regulation and to submit within 6 months of receipt of this notification

- a Framework Guideline on Grid Connection Rules;

- a Framework Guideline on Capacity allocation and Congestion Management

…

In developing the Framework Guidelines, you should apply the procedures and obligations as defined in the Electricity Regulation and the Agency Regulation, in particular with regard to transparency and consultation obligations

…"

ANNEX 3 - List of References

[1] "*ERGEG Final report, The lessons to be learned from the large disturbance in the European power system on the 4th of November 2006*", ERGEG, February 2007, Ref. E06-BAG-01-06, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Electricity/2007/E06-BAG-01-06_Blackout-FinalReport_2007-02-06.pdf

[2] *"Final Report on the disturbances of 4 November 2006",* UCTE (ENTSO-E Continental Europe), 2007, http://www.entsoe.eu/fileadmin/user_upload/_library/publications/ce/otherreports/Final-Report-20070130.pdf

[3] "*DENA Netzstudie*", (German), Deutsche Energie-Agentur, http://www.dena.de/fileadmin/user_upload/Download/Dokumente/Projekte/ESD/netzstudie1/dena-Netzstudie_I.pdf

[4] „*Final Report of the European Wind Integration Study*", UCTE (ENTSO-E Continental Europe), 2010, http://www.wind-integration.eu/downloads/library/EWIS_Final_Report.pdf

[5] "*UCTE System Adequacy Forecast 2009-2020*", UCTE (ENTSO-E Continental Europe), 2009, http://www.entsoe.eu/fileadmin/user_upload/_library/news/UCTE_SAF-2009-2020_Report.pdf

[6] "*European Commission Impact Assessment Guidelines*", http://ec.europa.eu/governance/impact/commission_guidelines/commission_guidelines_en.htm

ANNEX 4 – ERGEG

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.

The Council of European Energy Regulators (CEER) is a not-for-profit association in which Europe's independent national regulators of electricity and gas voluntarily cooperate to protect consumers' interests and to facilitate the creation of a single, competitive, efficient and sustainable internal market for gas and electricity in Europe.

CEER acts as a preparatory body for the ERGEG. ERGEG assists the European Commission in creating a single-EU market for electricity and gas. ERGEG's members are the heads of the national energy regulatory authorities in the 27 EU Member States.

This report was prepared by the Electricity Networks and Markets Task Force of the Electricity Working Group.