Regulatory aspects of the integration of wind generation in European electricity markets

A CEER Public Consultation

Ref: C09-SDE-14-02a

10-December-2009

European Regulators' Group for Electricity and Gas
Contact: Council of European Energy Regulators ASBL
28 rue le Titien, 1000 Bruxelles
Arrondissement judiciaire de Bruxelles
RPM 0861.035.445

INFORMATION PAGE

Abstract

As Member States (MSs) come under increasing pressure to deliver low-carbon, secure forms of energy, focus continues to rest on the deployment of renewable energy. Given the natural resources available and the associated costs, many MSs are concentrating their efforts on increasing their deployment of wind generation.

With this in mind, the Council of European Regulators (CEER) have a role in considering whether the regulatory regime for wind generation facilitates barriers to its deployment and/or distorts incentives in choosing where to locate in the EU. The report sets out the high-level issues for consideration, with the expectation that these can be further explored with the input of stakeholders.

Target Audience

Energy suppliers, traders, electricity customers, electricity industry, consumer representative groups, environmental groups, network operators, MSs, academics and other interested parties.

How to respond to this consultation

Deadline: **18 February 2010**

Comments should be sent by e-mail to **wind@ceer.eu**

If you have any queries relating to this consultation paper please contact:
Mrs Fay Geitona
Tel. +32 (0) 2788 73 32
Email: fay.geitona@ceer.eu

All responses except confidential material will be published on the website www.energy-regulators.eu.

Treatment of Confidential Responses

In the interest of transparency, ERGEG

i) will list the names of all respondents (whether confidential or not) or, alternatively, make public the number (but not the names) of confidential responses received; and

ii) requests that any respondent requesting confidentiality submit those confidential aspects of their response in a "confidential appendix". ERGEG will publish all parts of responses that are not marked confidential.

For further information on ERGEG's rules, see ERGEG Guidelines on Consultation Practices.

Related Documents

CEER/ERGEG documents

- CEER Status Review of Renewable and Energy Efficiency Support Schemes in the EU, Ref C08-SDE-05-03, December 2008. http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Electricity/2008/C08-SDE-05-03_RES%20and%20EE%20support_10-Dec-2008.pdf

- "Implementing the 3rd Package: The next steps", Ref. C09-ADG-04-03, March 2009. http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Cross-Sectoral/2009/C09-GA-52-06a_Imlementing_3rdpackage_18-Jun-09.pdf

- Revised ERGEG Guidelines of Good Practice for Electricity Balancing Markets Integration (GGP-EBMI), Ref. E09-ENM-14-04, September 2009. Available at: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Guidelines%20of%20Good%20Practice/Electricity/E09-ENM-14-04_RevGGP-EBMI_2009-09-09.pdf

- ERGEG Draft Guidelines for Good Practice on Electricity Grid Connection and Access, A Public Consultation Paper, Ref. E08-ENM-09-03, March 2009. http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/GGP%20Electricity%20Grid%20connection%20%20Access/CD/E08-ENM-09-03_GridConnection-Access_PC_11-Mar-09.pdf

- Draft European Energy Regulators 2010 Work Programme, Ref. C09-WPDC-18-03, September 2009, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/CROSS_SECTORAL/2010%20Work%20Programme/CD

External documents

- Please refer to Annexes 5 and 6 for a list of relevant references.

Table of Contents

Figures

Tables

EXECUTIVE SUMMARY

As the Copenhagen Climate Change Conference seeks to reach agreement on a new framework to address climate change, further attention is being given to the challenge of deploying low-carbon, secure forms of energy. In addressing this in Europe, Member States (MSs) are committed to deploy increased amounts of renewable generation. Depending on the natural resources available and the associated costs, many MSs are meeting this challenge by increasing their deployment of wind generation. However, wind generation's unique characteristics, which distinguish it from other types of generation, give rise to new issues relating to the design of the market and network arrangements of the regulatory regime.

European energy regulators are considering these issues to ensure that the regime facilitates the deployment of wind generation and does not inhibit market integration. The purpose of this report is to present European energy regulators' thoughts on how wind generation should be integrated into the market and network arrangements and to highlight areas for further consideration in light of its increasing deployment.

The paper begins by reviewing the current and expected role of wind generation, in light of the legal framework, to provide a context for assessing the policy impacts. It outlines the role of support schemes as a key issue for wind generation but also for energy customers, although this is an issue for governments rather than regulators. However, as the report goes on to discuss, it is important to bear in mind the interaction of support schemes with the costs that are borne by wind generators through network and market arrangements.

European energy regulators consider three areas in particular where integration of wind generation needs to be factored into policy decisions:

- electricity market arrangements, including the benefits for wind generation of allowing bids or declarations closer to real-time and the importance of within-day (intraday) markets and cross-border trade, as well as balancing by Transmission System Operators (TSOs) as a last resort to maintain balance between supply and demand;

- network access arrangements, such as the rationale for different forms of charging for connection and how decisions are made to extend the network to accommodate new generation, including in locations which may be remote from existing infrastructure. This includes regulatory issues as well as barriers such as difficulties in authorisation and permitting for new transmission lines; and

- the concept of an offshore supergrid, and the challenges in harmonising the range of differing policy and regulatory treatments, either on a broad scale or perhaps initially on regional projects.

This paper should be considered as a first step in discussions with stakeholders. The ideas presented in the paper should not be considered to represent CEER's definitive position on the subject. Rather, the report is intended to highlight the most important issues in integrating wind generation and to seek feedback from stakeholders as to how they should be addressed. In some areas, CEER points out principles that it considers to be relevant and on which it would welcome feedback. In many cases, detailed work on a particular topic relates to areas considered by European energy regulators. The conclusions from this consultation will serve to inform regulators' future work and understanding of the issues as they affect wind generation.

In addition, regulators envisage a further assessment of the implications and implementation of the Climate and Energy Package Renewables Directive in late 2010, once the initial national action plans are available. CEER will also continue to engage with a wide range of other projects and discussions.

European energy regulators hope that those stakeholders with a particular interest in the wind generation (and other renewables) sector will participate actively in the consultation. Regulators also welcome groups that are developing and discussing issues in the internal electricity market, such as the Florence Forum. It is no longer practical to consider renewables and electricity markets as two separate topics – it is essential to consider their interaction and to promote the integration of renewable generation in the wholesale electricity market.

Finally, CEER notes that these issues are not exclusive to Europe. CEER will therefore take a leading role in the assessment of best practices in accommodating renewables and distributed generation conducted under the auspices of the International Confederation of Energy Regulators (ICER)[1].

CEER invites all stakeholders interested in the regulatory implications of integrating wind generation into European electricity markets to respond to this consultation, both in general and in relation to the questions in Section 1.4. The deadline for responses is **18 February 2010** and instructions for responding are provided on page 2.

[1] For further information, see http://www.iern.net/portal/page/portal/IERN_HOME

1. Introduction

1.1. Objective of the report

Recent changes to the legislative context for EU energy, such as the new Climate and Energy Package[2] to help address sustainability objectives and the 3rd Package[3] to further liberalise energy markets, will have a significant impact on wind generation over the coming years. Wind generation has particular characteristics, such as its intermittent nature, which give rise to issues associated with the appropriate market and network arrangements for its use.

At the same time, further attention is being given to the idea of a "European supergrid" and the role offshore projects can play over the next 20 to 30 years. MSs and the National Regulatory Authorities (NRAs) are considering how to develop their regime to take account of the challenges these changes are bringing.

With this in mind, it is an opportune time for CEER to consider whether and how the developing market and network arrangements can facilitate the integration of wind, alongside conventional forms of generation. At the same time, European regulators are working for further market integration among MSs. It is likely that increasing proportions of wind generation will be physically traded among MSs over the coming years, as wind generation and interconnectedness increase, which will integrate MSs and regional markets further. It is therefore important that European energy regulators consider whether they enable this to occur effectively. The main purpose of this report is to

- Present the European regulators' emerging views on the issues associated with the integration of wind generation into the market and network arrangements;

- Highlight aspects of the market and network arrangements which may warrant further consideration in light of increasing deployment of wind generation;

[2] The "Green Package" was finally adopted on 23 April 2009. It includes 6 legislative acts: a Directive on the promotion of the use of energy from renewable sources (2009/28/EC); a Directive amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community (2009/29/EC); a Decision on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (406/2009/EC); a Directive on the geological storage of carbon dioxide; a Directive amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions from the use of road transport fuels (2009/31/EC); and a Regulation setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO 2 emissions from light-duty vehicles (Regulation (EC) No 443/2009). http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:140:SOM:EN:HTML

[3] The 3rd legislative Package proposals for the European Internal Market in Energy were finally adopted on 13 July 2009 and include 5 legislative acts: 2 amended Directives on the Directives amending Directive 2003/54/EC and Directive 2003/55/EC concerning common rules for the internal market in electricity (2009/72/EC) and the internal market in natural gas (2009/73/EC), respectively; 2 amended Regulations Amending Regulation (EC) No 1228/2003 on conditions for access to the network for cross-border exchanges in electricity (No 714/2009)and Regulation (EC) No 1775/2005 on conditions for access to the natural gas transmission networks (No 715/2009); and a new Regulation establishing an Agency for the Cooperation of Energy Regulators (No 713/2009). http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2009:211:SOM:EN:HTML

- Provide a useful review of how wind is currently treated within the network, market and regulatory framework across MSs; and

- To solicit feedback from stakeholders on whether they think regulators are proceeding in the right direction and what they think regulators should concentrate on in the future, in the context of the legal framework governing their activities and their responsibilities in relation to final consumers. This could then feed into other areas of work in CEER.

In addition to the above, the paper also briefly considers the regulatory issues associated with a potential European supergrid, which has as its objective the connecting-up of a number of national electricity networks and offshore wind farms.

The competencies of the NRAs extend to network and, in many cases, market arrangements. Therefore, the scope of this report is those network and market arrangements that impact on wind. Such consideration must recognise the role of support schemes for wind but as NRAs are not generally responsible for how these are developed or implemented, the paper does not include an in-depth analysis of their role in the integration of wind.

1.2. Methodology of the report

This report has been informed by the results of a questionnaire to CEER member and observer NRAs, which was circulated in May 2009. CEER has also met with a number of stakeholders, including TSOs, offshore developers, MS governments, academics and consultants. Information was also taken from various reports and sources, which are referenced accordingly. A summary of the significant sources is provided in Annex 5, with a full list of references in Annex 6.

1.3. Structure of the report

Section 2 explains why wind generation merits a specific discussion by NRAs, in light of its unique characteristics and the ambitious targets on MSs to increase their deployment of wind. It also clarifies what the role of the regulator is with respect to wind generation. Section 3 considers the framework in place for wind generation to trade within the market arrangements. Section 4 considers the issues to be addressed with respect to wind generation connecting and using the network. Section 5 looks at the issues associated with the deployment of a European supergrid, and includes a discussion on the smaller, regional projects that are under consideration. Finally, Section 6 concludes, including a discussion of possible future consideration by European Regulators.

Annex 1 provides a summary of CEER's functions. Annex 2 is a list of definitions of the terms and acronyms used in the report. Annex 3 contains a table that summarises some aspects of the network, market and regulatory framework arrangements for wind across MSs. Annex 4 provides further information on the treatment of wind within the market and network arrangements. Annex 5 is a summary of significant sources used and Annex 6 is a full list of references.

1.4. Questions for Public Consultation

In addition to inviting relevant stakeholders and market participants to respond generally to this consultation and participate in the discussions and the hearing on this document, CEER seeks the opinion of respondents on a number of specific issues related to the scope and applicability of the document.

The respondents are therefore invited to reply and provide comments on the following questions:

Question 1: How will the expected growth in wind generation affect the markets in which you operate? What are the key challenges you foresee?

Question 2: What are the implications for market rules? Can you identify changes which would better facilitate integration of wind generation, including management of intermittency?

Question 3: Would moving the market's gate-closure closer to real-time facilitate the deployment of wind generation? Would this have any adverse consequences on the functioning of the electricity power system?

Question 4: Are emerging cross-border congestion management models compatible with wind generation? Should further attention or priority be given to intraday capacity allocation mechanisms and markets, in light of the issues associated with forecasting wind generation?

Question 5: Should wind generation be subject to the same balancing obligations and the same types of charges as other types of generation?

Question 6: Should TSOs engage in research and development (R&D) to address issues associated with a large share of wind generation included in the network? If so, how should the regulatory framework require or support this?

Question 7: Should wind generators face the same types of network charges as other new generators, calculated using the same methodology? What is needed to provide a sufficient incentive for generation in choosing where to locate? What is needed to provide an appropriate balance of risk among market players? When should this not be the case?

Question 8: Broadly, what is the appropriate allocation of responsibilities, risk and cost among market players in developing new network infrastructure (e.g. ahead of or in response to new generation connections)? Should this be different for wind generation? Where is harmonisation required?

Question 9: Do you agree that the "supergrid" issues for regulators identified in 5.1 are relevant? Is there anything else European regulators should be considering?

Question 10: Is the current ownership structure of the offshore lines or their regulatory framework a potential issue for the integration of offshore network? Are there other considerations affecting this ownership structure?

Question 11: Do you agree that the Regional Initiatives should be used to address the issues associated with the development of the regional projects? What challenges does this present?

Question 12: What other issues should European regulators consider in relation to the integration of wind generation?

2. Scoping the challenge

2.1. The nature of wind generation and the existing regimes

The characteristics of wind generation, which distinguish it from other types of generation, often result in issues for regulators, investors and policy-makers in developing the appropriate market and network arrangements. Firstly, wind generation usually connects to the grid in electrically remote locations. This means that additional grid infrastructure is required to transport the energy from where it is generated to where it is consumed. Secondly, wind has a number of technical characteristics which differ from that of conventional generation – wind generation projects are typically smaller, but more numerous, than conventional generating stations. Thirdly, wind generation is intermittent[4], with a degree of unpredictability. Furthermore, wind has low[5] short-run marginal costs compared with conventional generation meaning that, in systems with substantial wind penetration, conventional generation may increasingly be utilised in a reserve capacity. It is also typically less effective in its ability to provide reactive power than conventional generation. Finally, the scale of new entry in some MSs is potentially very significant. For example, from its current base of having 9% of electricity consumption produced from renewable sources, the Irish Government has set a target of 40% by 2020[6].

Furthermore, implications of wind generation for the power systems and its treatment vary considerably across MSs, according to different system characteristics such as generation mix, the penetration of renewables, the location of energy sources and demand and the market and network arrangements. This represents a further consideration for investors and regulators.

2.2. The legislative context

The EU's Climate and Energy Package, adopted in April 2009, seeks to provide a framework to promote increased sustainability in energy and transport markets in the EU. While the package is rather wide-reaching[7], it is the new Renewables Directive[8], which must be implemented by MSs by December 2010, which is of particular relevance to this report. This sets an overall binding target of 20% of energy consumption[9] from renewable sources by 2020. The biggest contribution to the targets is expected to come from the electricity sector.

To help meet this target, the new Renewables Directive establishes certain provisions, such as:

- MSs shall provide for either priority access or guaranteed access to the grid system for electricity produced from renewable energy source, subject to requirements relating to the maintenance of the reliability and safety of the grid;

[4] In this report, "intermittent" refers to wind generation's availability to generate varies with meteorological conditions.
[5] Or negative short-run costs if/when the support provided through a scheme is included.
[6] Based on 2007 data. Source: Renewable Energy Policy Review: Ireland, EREC and http://www.environ.ie/en/Environment/News/MainBody,18676,en.htm.
[7] See Footnote 2.
[8] 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.
[9] Energy is not limited to power but includes energy for heating, cooling and biofuels, etc.

- MSs shall ensure that when they dispatch electricity, TSOs give priority to generating installations using renewable energy sources in so far as the secure operation of the national electricity system permits[10]; and

- MSs may engage in statistical transfer of renewable energy production and establish joint renewable projects in one or more MS. They may also combine their support schemes for the promotion of renewable energy.

The efforts required in meeting the targets are very substantial, with most MSs needing to more than double their deployment of renewable energy in order to meet their target[11] (see Figure 1). Given the natural resources each MS enjoys, such as wind (see Figure 2), and the technologies that have been employed to date (see Figure 3), it is likely that many MSs will meet a significant portion of their target through the deployment of wind generation.

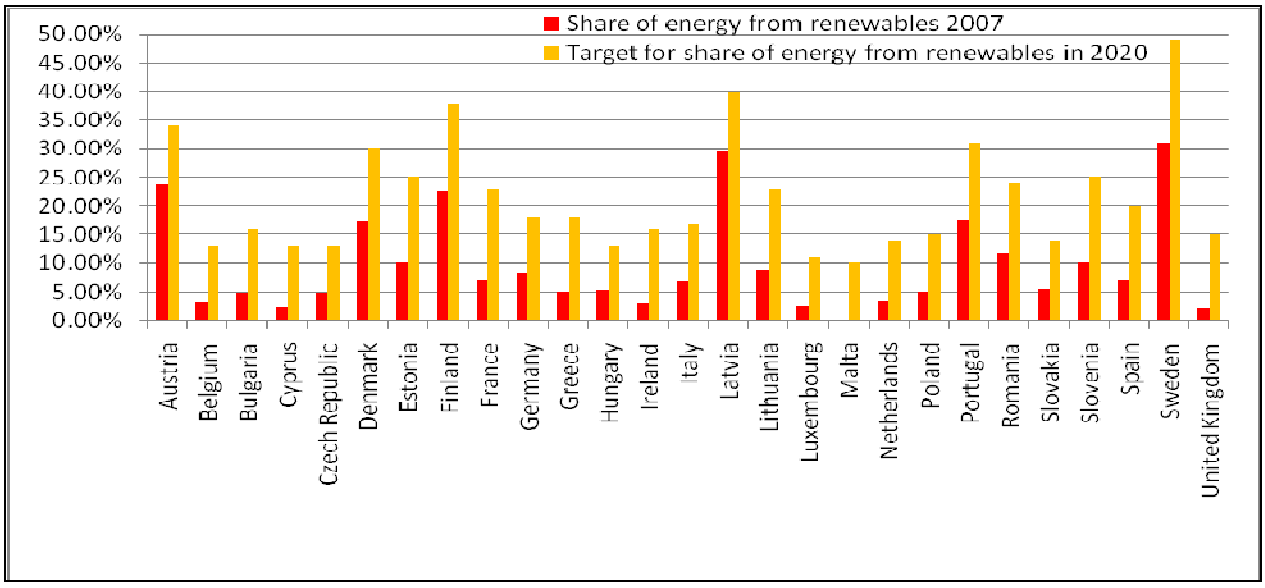

Figure 1: Consumption of energy[12] from renewables (MWh), 2007 versus National 2020 targets for the share of energy from renewables

Source: Eurostat

[10] The old Directive (2001/77/EC) has a similar provision but with the caveat that it was subject to "the operation of the national electricity system". The clause on operation was viewed as being more open to interpretation than the new proposal for the clause on security.

[11] In fact, just 6 MSs are over half-way in meeting their target.

[12] See Footnote 9.

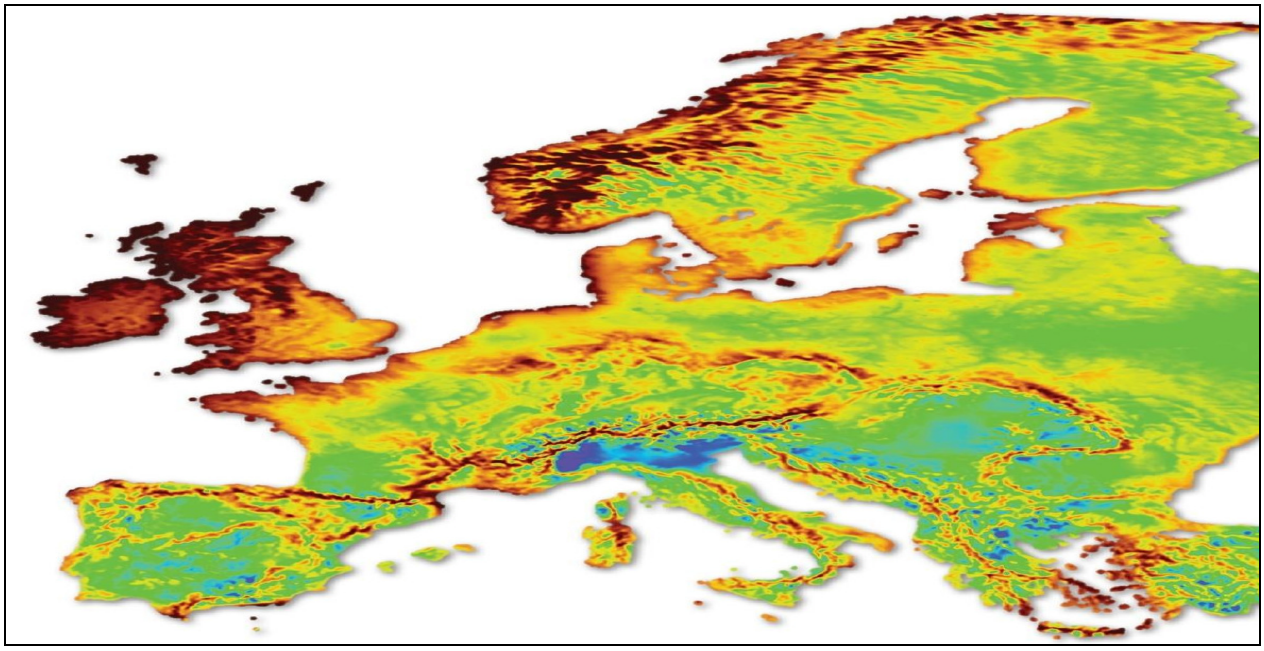

Figure 2: Europe wind map at 80m

Source: Copyright © 2009 3TIER, Inc

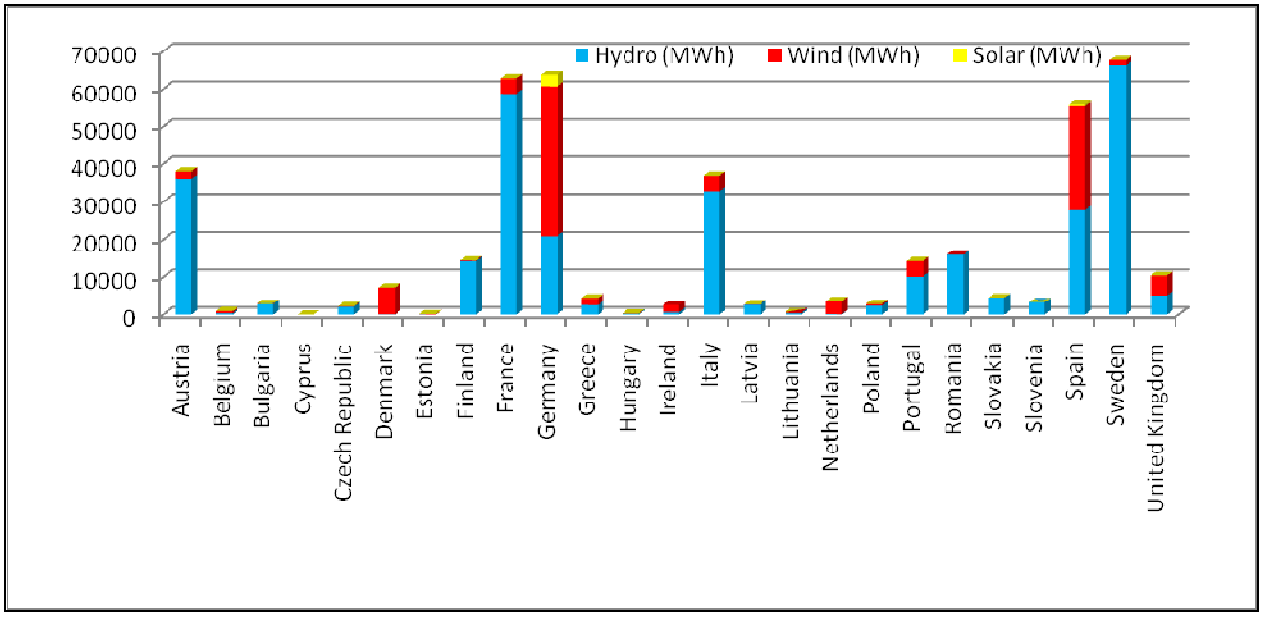

Figure 3: Energy from renewables (MWh), 2007

Source: Eurostat

2.3. Role of NRAs

The primary statutory duty of European energy regulators is to protect and promote consumers' interests. NRAs do this by helping to facilitate competitive, efficient and sustainable energy markets, where appropriate. Some NRAs have an explicit obligation to have due regard to the environment.

However, this does not extend to the promotion of any one type of generation. Within this context, regulators recognise that wind is one form of low-carbon generation and do not intend for this report to distract from the important debates relating to other types of generation, such as nuclear and solar, and carbon capture and storage. Nevertheless, the expected growth of wind generation gives rise to new issues relating to the design of market and network arrangements. Regulators have a duty to consider these issues and to consider also whether the regulatory regime facilitates, or creates barriers to, the deployment of wind generation.

It should be noted that the achievement of renewable targets and the associated support for renewables are a matter for governments and, as such, are outside the direct remit of the NRAs. While this report touches on the design of support schemes for wind, in line with encouraging best-practice in the treatment of wind generation, it does not consider them in depth[13].

Furthermore, while it is important for European energy regulators to consider the specific issues relating to the market and network arrangements for wind generation, this must be done in the context of progress towards a competitive, liberalised EU energy market. The recently-agreed 3rd Package legislation, which provides for more strict separation between network ownership and generation and supply interests, increased transparency and a stronger voice for European regulators, should help to address some of the fundamental barriers to the deployment of new generation, including wind generation. Furthermore, the forthcoming legally-binding network codes for cross-border trading, such as those relating to network connection, third-party access and balancing, should contribute to resolving some of issues[14]. NRAs and the forthcoming Agency for the Cooperation of European Regulators (the Agency) will play a role in their monitoring and development through non-binding Framework Guidelines, which will set the objectives for the codes[15].

[13] For a discussion and comparison of renewable support schemes in the EU, see CEER's "Status Review of Renewable and Energy Efficiency Support Schemes in the EU", Ref C08-SDE-05-03, December 2008. Available at: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Electricity/2008/C08-SDE-05-03_RES%20and%20EE%20support_10-Dec-2008.pdf

[14] For further information on the 3rd package, see CEER's "Implementing the 3rd Package: The next steps". http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Cross-Sectoral/2009/C09-GA-52-06a_Imlementing_3rdpackage_18-Jun-09.pdf

[15] As provided for by Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for Access to the network for cross-border exchanges in electricity.

2.4. Support schemes for wind

The type of support schemes available for wind generation, such as feed-in tariffs (with or without a premium), tradeable certificates, tax exemptions and investment grants, generally represents the strongest incentive in developing new projects. To ensure the investment is economic and efficient, MSs should concentrate on providing support for wind generation through these support schemes rather than through the grid and market arrangements.

Furthermore, the success of the support scheme can be influenced by the market and network arrangements, and how they interact with each other[16]. Therefore, it is important that the incentives provided through the support scheme are compatible with the treatment in the market and network arrangements (and vice versa).

In this vein, it is important that the support scheme is volume-based, transparent and provides clear signals to the market, wherever this is appropriate. For example, where support is provided through exemption from costs paid by other market participants, such as connection charges or imbalance payments, the incentives in choosing where to locate or in managing system constraints, say, may be dulled.

This has implications for the effectiveness of the market and network arrangements. Indeed, support schemes which are transparent, explicit and separate from market and network arrangements, such as a feed-in tariff or certificate scheme, are arguably better at providing the appropriate incentives.

At the same time, it is also important that the price for electricity produced from carbon fuels reflects the environmental impact it causes so that the market receives the appropriate signals in choosing where to invest. European energy regulators look forward to the introduction of the next phase of the EU ETS, from 2013 onwards, where full auctioning of carbon emissions in the power sector should provide clearer signals and increased economic efficiency to the market.

[16] As noted by, for example, Klessmann, 2008, “Pros and Cons of exposing renewables to electricity market risks – A comparison of the market integration approaches in Germany, Spain and the UK”. Available at www.elsevier.com

3. Market arrangements and wind power

Wholesale market design refers to how generation is offered to the market and traded within it. It concerns issues such as the gate-closure times (GCTs), cross-border capacity allocation and the cost of and responsibility for balancing. As with other types of generation, these arrangements are important to wind generation and they differ among MSs (see Annexes 3 and 4).

3.1. Gate-closure times

The GCT refers to the final moment in which market players are able to trade electricity or inform the balancing-responsible party of their position before real-time delivery, without it affecting their balance position (where relevant). It represents the closure of market actions, either in the forward, day-ahead or intraday timeframe (whichever one of these timeframes is closest to the real-time). Figure 4 shows the GCTs that exist for each MS[17].

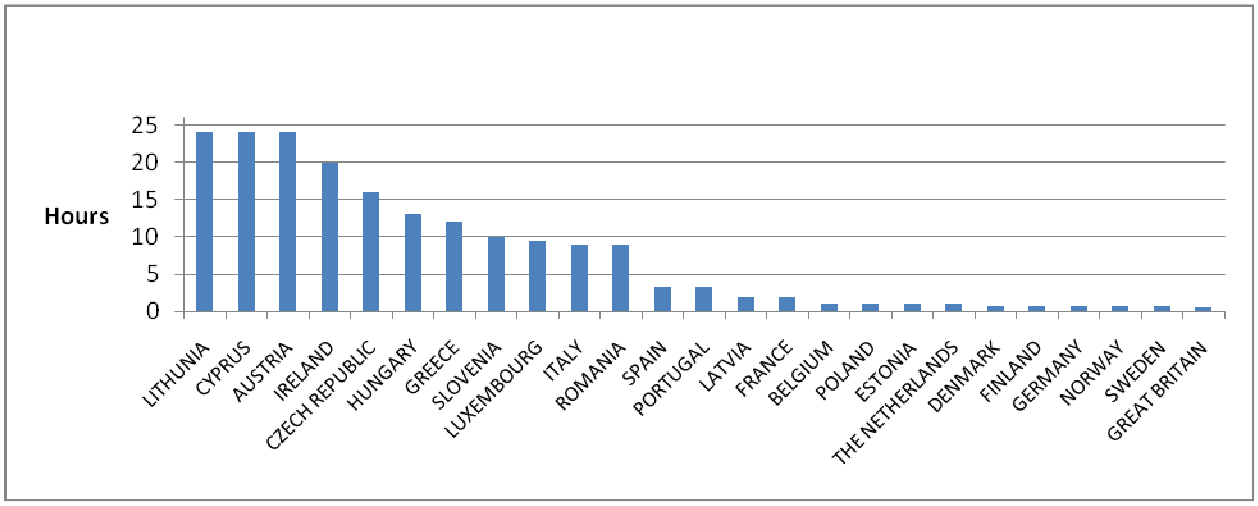

Figure 4: Time between closure of forward market and real-time delivery

Source: CEER NRAs. Information not available for Bulgaria, Iceland, Malta and the Slovak Republic.

[17] For Cyprus, Latvia and Poland the answer refers to gate-closure time for wind generation as there is a different gate-closure time for conventional generation. Note that gate-closure has different meanings in different electricity wholesale market models. For example, for gross mandatory pools such as the Single Electricity Market (SEM) in Ireland, gate-closure generally refers to the final moment that market participants have to submit their commercial offers for central commitment and scheduling to the (market) operator ahead of real-time operation. In central commitment markets such as the SEM, there is no balancing market.

Due to its nature, it may be difficult to forecast the proportion of wind generation that will be available the following day (day-ahead) and further out. For example, the day-ahead prediction error in Germany is over 20%, but decreases significantly closer to real-time[18]. For this reason, it may be preferable to have a gate-closure in the intraday time frame closer to real-time. This may help further encourage market participation by wind generation and reduce system balancing costs. Indeed, it has been shown that a gate-closure near real-time would reduce balancing costs, since fewer thermal stations would need to be started up, only to be replaced by previously unexpected wind generation[19].

In light of this, it may be worth considering whether there are valid reasons for having the particularly longer GCTs that exist in some MSs and whether these longer GCTs represent an entry barrier to wind generation (and also other market participants), especially if they exist alongside incentives for balancing and/or penalties for imbalance.

3.2. Cross-border market integration

Given the diversity of benefits, it is possible that physical cross-border trading will play an increasingly important role in meeting MS demand and mitigating fluctuations caused by unpredictable wind patterns.

Over recent years, there has been significant progress in developing models for cross-border capacity allocation and congestion management in electricity as key steps on the path to market integration. This has been drawn together and taken forward by the "Project Coordination Group" (PCG) established through the Florence Forum[20]. Regulators envisage that the Framework Guidelines and Network Codes foreseen by the 3rd Package will provide a vehicle for assessment, consultation and eventual adoption, via Comitology, of binding codes on such models.

It is therefore important to consider how the package of models being developed will accommodate wind generation. In brief, the arrangements foreseen include:

- explicit longer-term auctions of capacity on interconnectors (timeframes such as monthly, annual and potentially multi-year), for either physical or financial transmission rights;
- at the day-ahead stage, implicit allocation of all (remaining) capacity through single price coupling;
- intraday inter-regional markets having implicit continuous trading with the possibility of having some intraday implicit auctions for additional transmission capacity; and
- balancing between TSOs using any remaining available capacity and TSO-TSO model with the aim to have a common merit order.

[18] Weber, 2009, “Adequate intraday market design to enable the integration of wind energy into the European power systems”.
[19] Musgens and Neuhoff, 2006, “Modelling dynamic constraints in electricity markets and the costs of uncertain wind output, Cambridge Working Paper in Economics.
[20] For further information, see http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_WORKSHOP/Stakeholder%20Fora/Florence%20Fora/PCG

As noted above, wind generation can be difficult to predict at the day-ahead stage but becomes more (if imperfectly) predictable closer to real-time. This leads to the question about how significant proportions of wind capacity should be taken into account when all physical capacity is allocated at the day-ahead stage. Adjustments to the use of capacity would be possible in the intraday, but only if capacity is available.

In theory, alternatives could be either to move the implicit allocation closer to real-time or reserve some capacity for intraday markets. The implementation of implicit allocation in intraday goes in that direction and should be of higher priority. It may also be helpful to consider the importance of intraday markets, together with day-ahead markets, as part of ERGEG's input to framework guidelines on capacity allocation and congestion management. Another priority should be the development of cross-border balancing capacity. Indeed, this would give increased flexibility to TSOs to keep the system balanced, especially in a context of high penetration of wind power.

Within this context, it may also be worth considering how different cross border GCTs, especially among neighbouring countries, may act as a barrier to cross-border trading and the efficient and effective functioning of offshore networks between MSs (see Section 5). For example, within the France-UK-Ireland (FUI) region, the gate-closure time varies between 30 minutes (Great Britain) and 20 hours (Ireland).

More generally, in attempting to integrate the markets further, it is important to consider the nature of each market and its current and potential generation mix. It would be unhelpful if the revised arrangements act as a barrier to managing the increasing amount of wind generation in Europe. In light of this and within the context of ongoing European discussions about congestion management for European interconnectors, it is worth highlighting the importance of having intraday markets that allow participants to re-optimise their portfolio, to complement the focus on day-ahead capacity allocation. The aim would be to mitigate potentially high imbalance costs faced by wind generators (where applicable given the electricity wholesale market design) and allow for excess generation in one area to be applied in another area with different conditions.

3.3. Balancing and reserve markets

3.3.1. Cost-reflective balancing markets

As electricity cannot be easily stored and in order to ensure the security and quality of the supply in the system, electricity supply must equal demand within the operational period. On the one hand, market parties should be incentivised to be balanced, in particular through the cost-reflectivity of balancing. On the other hand, they should be given the means to be balanced, for instance thanks to the development of efficient cross-border within-day markets at the European scale.

Given the difficulty in forecasting wind generation far from real-time, it is important to consider which party bears the cost of providing these balancing services, combined with the GCTs. This varies among MSs, but nine regimes[21] provide wind generation with a financial incentive to

[21] Belgium, Denmark, Great Britain, Latvia, Norway, Slovenia, Spain, Sweden and the Netherlands.

balance their portfolio.

In order to enable wind generation to integrate more fully in the market and to compete against other types of generation, it is worth considering the cost-reflectivity of balancing settlements and services. Balancing arrangements should provide the same incentives for wind generation to balance as for other types of generation[22]. Indeed, being in charge of its imbalances may incentivise wind generation to invest in forecast tools in order to reduce their balancing costs and encourage more innovative ways to address the problems associated with forecasting wind. However, different approaches are feasible. In Portugal and Spain, for example, where wind generators are financially responsible for their imbalances, the market offers forecasting services by collecting weather forecasts and aggregating all wind farm data[23]. In Italy, there is a different approach – wind energy forecasting is done at system level as an input to the balancing market and imbalance costs are paid for by consumers[24].

Furthermore, increased market integration could reduce the costs of integrating wind power and other intermittent and difficult to predict sources of energy. Indeed, making adjacent markets compatible would enable TSOs and market players to have access to a larger market in which to balance. Within this context and as with the debate on the compatibility of GCTs (as above), it is worth focusing on within-day markets to lower barriers to wind in the future.

3.3.2. The role of the TSO in balancing

The TSO is responsible for ensuring the system is in balance at real-time within the operational hour, and may be required to bring on additional reserves or constrain generation in order do this. In order to minimise the costs of this service for all users, it is helpful for the TSO to be incentivised to efficiently and effectively procure and manage reserves over varying timescales. It is worthwhile for NRAs to consider whether the regulatory regime provides a sufficiently strong incentive for TSOs to do this.

Furthermore, within the context of encouraging wind generators to manage their output as efficiently as possible, it may be worthwhile to consider also whether TSOs/DSOs/Balancing Responsible Parties (BRPs) have the appropriate incentives to consider innovative ways to address the issues associated with having an intermittent generation source, such as wind. NRAs could encourage the TSO/DSO to improve their operation rules regarding wind generation and to adequately enforce appropriately technical and fair performance rules for wind generation.

---

[22] For further information on the key principles for efficient electricity balancing markets and their integration, please see the Revised ERGEG Guidelines of Good Practice for Electricity Balancing Markets Integration (GGP-EBMI), September 2009. http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Guidelines%20of%20Good%20Practice/Electricity/E09-ENM-14-04_RevGGP-EBMI_2009-09-09.pdf

[23] As noted by Hiroux, 2009, “Market design for a large share of wind power”.

[24] On one site, forecast is done by the TSO (TERNA) and used as an input to the balancing market. On the other site, Gestore Servizi Elettrici (GSE) has a role in both forecasting wind production and providing renewable power to the system when requested to do so by wind generators. In 2008, the error margin between forecasts and output of both systems, on an hourly basis, was about 20-30% of real wind production.

4. Network arrangements for wind generation

One of the key issues in developing a wind generation project is the connection to the network. In some cases, wind generators may choose to locate far from the existing grid (including offshore), perhaps because the wind resources are better. This can mean the connection takes longer and is more expensive. This Section highlights a number of the network issues arising in relation to wind generation. Some of these are addressed in detail in other CEER/ERGEG work – in these cases the text summarises how the issue relates to wind generation but cross-refers to other work rather than repeating full details.

Given the importance of these arrangements to the operation of the network and the costs involved for investors and consumers, it is important that sufficient consideration is given to whether the arrangements facilitate, as much as possible, fair and non-discriminatory access to the system for wind generation and whether the differences across MSs distort investment decisions.

4.1. Authorisation procedures

Given the significant volume of new capacity, much of it from wind generation that will be seeking to obtain access to the system, there may be relatively long lead times in connection dates due to insufficient capacity being available to accommodate the new generation and public reluctance to accept the impact of this investment on their local environment.

The complex processes and unpredictable timetables for building and construction authorisations and permission processes in many MSs are a major issue. Regulators reiterate the call for governments to speed up the processes for building and construction authorisations of transmission lines, including land planning, with clear criteria, transparent guidelines and deadlines, appropriate appeals mechanisms and the consistent and transparent definition of the roles of various authorities.

At the same time, it may also be worthwhile considering the appropriate sharing of existing network capacity among generation – it should be allocated fairly and on a non-discriminatory basis with the possibility of flexible contracts for the trading of capacity.

4.2. Network connection criteria

Any form of generation connecting to a transmission (or distribution) network will be required to meet certain technical criteria for connection. It is essential to have such connection criteria to ensure the operational security of the network, to ensure that the performance of the generator in response to varying conditions can be foreseen and to ensure that it is not unduly disruptive to the safe and secure operation of the network. The details in these connection requirements may have been developed with conventional generation in mind, and could imply costs for wind generation. It is therefore necessary to consider which aspects are necessary in all cases, whether the costs outweigh the benefits and whether it is reasonable to allow exemptions from requirements.

The overall rules for grid connection have recently been assessed in the ERGEG Guidelines of Good Practice on Grid Connection and Access [25]. They are now the subject of a pilot project to develop draft Framework Guidelines on Grid Connection.[26] The European Network of TSOs for electricity (ENTSO-E) is working specifically on a pilot network code on grid connection for wind generation. Consideration of this issue will therefore be taken forward through that work.

4.3. Network charges

In general terms, new generation (or load) connecting to a network will typically be required to pay a connection charge, which may cover the costs of any network extension and, in some cases, part or all of the costs of any upstream network reinforcement required to accommodate the generator. In general terms, the ongoing cost of running, maintaining and renewing the network is remunerated through network 'use of system' tariffs, levied on demand customers and in some cases on generators.

In principle, these connection and 'use of system' charges should be transparent and cost-reflective to ensure that:

- there is no undue discrimination against one type of generation (uniform charging regime);
- it provides sufficient incentives for generation in choosing where to locate; and
- there is an appropriate balance of risk and cost to the various market players.

From an economic perspective, the socially-optimal location for a particular generation project will take account of all of the costs and benefits of operation in that location (including the environmental benefits of displacing fossil fuel generation). The benefits can be approximated by the revenue of the generator, which will typically include subsidies for wind generators to reflect their environmental (and arguably security of supply) benefits. It is therefore important that the generator also takes account of the costs it imposes on the network, which can vary significantly by location. This is achieved by charging those costs to the generator.

There is currently a range of approaches to connection charges ranging from shallow to deep and, where relevant, network tariffs across MSs. In particular, for some MSs, wind generators do not pay network tariffs[27]. (On the other hand, some MSs require the full cost of reinforcement to be paid by the generator that triggers the reinforcement). This can lead to free-rider issues (if the second generator accesses the enhanced network without contributing) which can be a barrier to the first mover. An alternative could be to fund reinforcement costs through network tariffs so that all those that use the enhanced network pay, perhaps based on long run marginal costs. On the other hand, this can give rise to concerns about the variability of these charges.

[25] For a discussion on the technical issues relating to the connection of wind, see ERGEG Draft Guidelines for Good Practice on Electricity Grid Connection and Access, A Public Consultation Paper, March 2009. Available at: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/GGP%20Electricity%20Grid%20connection%20%20Access/CD/E08-ENM-09-03_GridConnection-Access_PC_11-Mar-09.pdf

[26] http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_FWG/Electricity/Grid_Connection

[27] For example, in Cyprus and Greece, wind generation is not required to pay anything towards the costs of using the system. In 12 regulatory regimes (Belgium, Cyprus, Denmark, Finland, Germany, Greece, Italy, Poland, Portugal,

In light of these considerations, it is perhaps not surprising that different MSs have chosen different approaches. None are necessarily better or worse for wind generators in aggregate – this depends on the interaction with the level of subsidy (one might expect higher explicit subsidies would be required where the generator has to pay for network costs, although the greater incentives for efficiency should mean total costs are lower). One question is whether there would be benefits from harmonisation; another is whether there is justification for not having cost-reflective charges and slightly higher subsidies to compensate for the average cost of this.

Furthermore, the connection arrangements in many MSs distinguish wind generation (and other renewables) from conventional generation. For example, 9[28] regimes for onshore provide for priority connection of wind over conventional generation and 4[29] provide for a more favourable 'use of system' charging regime for wind generation compared with conventional generation[30]. It is worth considering whether this creates sub-optimal outcomes for the network, such as insufficient conventional generation (particularly important at high demand/low wind resources and for ancillary services) or a distortion of incentives in choosing where to locate generation.

4.4. Network development

One of the challenges in connecting new generation is that the lead times for developing new network infrastructure may be longer than the lead times for constructing the generator, for example due to authorisation and consent issues noted above. In this context, network planning models can in principle vary on a spectrum between "predict and provide" through to fully-funded only. That is, networks could be developed based on an estimate of what might be needed (predict and provide), which risks building assets which are not used, or the network may only be developed when a new generator has fully committed to fund (its share of) the costs, which risks long delays in connection. In addition, renewable generation may receive priority treatment relative to conventional generation.

In part, this is a question of who should bear the risk associated with network development. From CEER's NRA survey, it appears that 12 MSs[31] provide for full cost-pass through of the costs of network reinforcement to accommodate wind generation so that consumers pay the total cost. In such cases, it is worth considering whether this provides incentives to gold-plate or over-provide, which could lead to stranded assets. In practice, this may depend on more detailed aspects of the regulatory framework.

Romania, Slovenia and the Netherlands), wind generation is not required to pay anything towards the cost of grid reinforcement.

[28] Belgium, Cyprus, Czech Republic, Denmark, Germany, Italy, Lithuania, Spain and the Netherlands.

[29] Belgium, Cyprus, Greece and the Slovak Republic.

[30] Some MSs "group" connection offers together. In Ireland, this is done for all renewables through the "group processing approach". For further info, see http://www.cer.ie/en/electricity-transmission-network-decision-documents.aspx#ConnectionPolicyDocuments

[31] Belgium, Cyprus, Denmark, Finland, Germany, Greece, Italy, Poland, Portugal, Romania, Slovenia and the Netherlands.

The appropriate level of risk that TSOs should face in developing the network, in response to the changing generation mix, is also worth considering. NRAs could serve an important role in encouraging the TSOs to take increased risk, with commensurate rewards, in fostering a more innovative and dynamic approach to the development of the network. For example, the NRA in Great Britain, as part of a wider two-year project to review the workings of the current approach to regulating networks, is considering how to encourage appropriate building of anticipatory infrastructure through the framework of financial incentives applied and, where appropriate, increased competition[32]. The role of the forthcoming Community-wide, regional and national ten-year network development plan[33] should also play a role in assisting TSOs to consider the evolving challenges of the network. In particular, by consulting on these plans and how they inter-relate with network developments in other MSs, the information available both to market participants and to TSOs may be improved (although it may be considered that information provided by market participants would be more valuable if there is a financial commitment attached). Significantly, better solutions may be found by considering regional developments rather than purely national ones.

The issue of network development also relates to the "quality" of development as well as the quantity. There is now significant interest in the development of so-called smart grids, making better use of network infrastructure through active management of demand and generation. There is enormous potential for this to facilitate the integration of intermittent generation, for example through shifting demand patterns in response to varying generation just as new generation patterns are varied to accommodate fluctuations in demand. Part of the issue here lies in the deployment of new technology. CEER found that 5 regimes[34] provide for a specific return or incentive for TSO/DSO R&D. ERGEG's consideration of these issues is being taken forward through separate work on smart grids[35].

4.5. Role of government

The deployment of wind generation in more remote areas has led, and will lead to, new transmission infrastructure being required in the future. Whilst respecting governments' roles in meeting the renewables targets, NRAs have a responsibility for protecting consumers from inappropriate or inefficient cost increases associated with building of these new connections. In light of this, there may be some cases where it would be worthwhile considering whether governments should fund strategic network development directly in order help achieve the renewable targets.

[32] For further information on Ofgem's RPI-X@20 project, see http://www.ofgem.gov.uk/Networks/rpix20/Pages/RPIX20.aspx.
[33] As provided for under the 3rd Package.
[34] Estonia, Great Britain, Ireland, Romania and Slovak Republic.
[35] See forthcoming ERGEG Position Paper on Intelligent Electricity Networks, An ERGEG Public Consultation Document. Available at www.ceer.eu.

Furthermore, it is interesting to note the role of government in the development of the network and the regulatory regime. The 3rd Package requires NRAs to be independent from government and places an obligation on them not to "seek or take direct instruction"[36] from government. However, currently, 5 regimes[37] do allow government to have a role in determining how the network should develop in some way.

[36] Article 35, Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity
[37] Great Britain, Hungary, Italy, Portugal and Spain.

5. A European supergrid

Political support has been growing for a European supergrid which would connect the electricity grids of MSs and numerous offshore wind farms across Europe. It is argued that such a network, which could enable Europe to share and maximise its resources of wind, solar, hydro-power and geo-thermal energy could go a significant way in satisfying a competitive, sustainable and secure energy market for the 21st century. Indeed, the European Commission, in its 2nd Strategic Energy Review[38], called for a push towards progress on modular development of a European "supergrid" and there are a number of projects and groups[39] committed to providing policy recommendations to deliver this.

5.1. A role for European regulators

European regulators see the advantages of such projects: opening the scope of the relevant market is a promising opportunity to foster cross-border trade and to improve competitiveness, sustainability and security of supply in the whole area. However, in the absence of a single, integrated energy market with a "super-regulator" and a "super-system operator", regulators are aware that there may be potential regulatory barriers associated with the building of a European supergrid. Regulators have a responsibility to address them where they can. For regulators, issues for further consideration relate to:

- **Who pays and who benefits:** For regulated network infrastructure, the NRA has a role in approving the return owed to the TSOs for construction and operation of interconnection and offshore transmission assets. Given that MS consumers fund this through their bills, the NRA must ensure that the investment is efficient, economic and gives sufficient benefit to their consumers, such as increased competition or security of supply. Funding required for European priorities such as a supergrid must be proven to benefit consumers;

- **The potential distortion created by different regimes:** Consideration may need to be given to whether there are such significant differences in market and network arrangements among MSs that they distort the incentives generation has to locate in the most efficient spot and to connect to more than one MS;

- **The compatibility of interconnection and transmission regimes:** Where there is evidence that combining the use of interconnection with transmission is efficient and economic[40], further attention could be given to considering whether the existing licensing regimes, and the obligation to have different types of licences, adequately meet the developers' needs; and

[38] http://ec.europa.eu/energy/strategies/2009/2009_07_ser2_en.htm

[39] Such as the Pentalateral Energy Forum (composed of government representatives from Belgium, France, Germany, Luxembourg and the Netherlands); the OffshoreGrid project (www.offshoregrid.eu); ENTSO-E's North Sea Region Working Group (www.entsoe.eu); the TradeWind project (www.trade-wind.eu); the European Wind Integration Study (www.wind-integration.eu); and the Coordinator for the NorthSea Offshore grid (http://ec.europa.eu/energy/infrastructure/tent_e/coordinators_en.htm).

[40] There is some evidence to suggest this is the case in certain projects. For example, Scottish and Southern Energy, in its Den Helder project between the UK and the Netherlands, have said that they have identified an opportunity to integrate connection of wind farms with an interconnector.

- **The current ownership arrangements for offshore transmission**: Currently, the most common type of ownership arrangements offshore is for the generator to own the cable[41]. While this approach may be practical whilst the predominant types of offshore transmission lines are point-to-point radial connections, this may require further consideration in light of the 3rd Package unbundling requirements[42] and as offshore transmission lines increase their capacity and come to resemble more closely a network.

A further issue for consideration, though not directly for NRAs, relates to the compatibility of support schemes (and whether differences distort investors' incentives in choosing where to locate). It is also important that, as more MSs build networks further out to sea and where these areas have the potential to cross over with each other, MSs consider their activities within the context of international law[43]. This highlights the importance of regional co-operation and dialogue among neighbouring MSs[44].

Finally, in considering the issues associated with developing a European supergrid, it is important that attention be paid to the merits of the regulatory regimes that are already in place and those being developed. Minimising regulatory uncertainty is essential and getting both a coordinated approach, that is ambitious and strategic, and a practical, bottom-up approach that is aware of the realities "on the ground" is highly important.

5.2. Regional projects

In developing a European supergrid, it has been suggested[45] that the approach should focus on modular development, with particular attention being paid to the smaller projects of Kriegers Flak, the North Sea offshore grid and the Mediterranean Energy Ring.

5.2.1. The Kriegers Flak project

This project could connect up to 1800MW between Nordic countries of Denmark, Germany and Sweden. It is arguably the most developed of the regional projects under discussion: the European Commission's 2009 economic stimulus package provided €150m for the project and the TSOs[46] involved have recently completed a pre-feasibility study of the project.

[41] In many MSs, these are connection lines and are owned by the generator only.

[42] Article 9 of Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity requires that "the same person or persons are entitled neither directly or indirectly to exercise control over an undertaking performing any of the functions of generation and supply, and directly or indirectly to exercise control or exercise any right over a transmission system operator or over a transmission system" (and vice versa).

[43] For example, 4 countries have built offshore wind farms outside of their territorial waters (which is usually considered to be within 12 nautical miles from the coast). In recognising international law, in 2004 the British government made a claim under international law to have Renewable Energy Zones outside of its territorial waters, which would provide it with exclusive rights to build offshore wind farms in these areas.

[44] For example, through initiatives such as The Pentalateral Energy Forum.

[45] For example, by the EC's Co-ordinator for the North Sea offshore grid, Mr Georg Adamowitsch.

[46] Denmark's Energinet.dk, Sweden's Svenska Kraftnät and Germany's Vattenfall Europe Transmission.

It has also been a particular focus for the European Co-ordinator for the North Sea grid, Mr Georg Adamowitsch, as a case study to identify issues for future developments.

Issues for the relevant NRAs to consider include agreement on the appropriate sharing of costs in building the network and the accrual of renewable targets among the MSs, addressing the different market arrangements in balancing wind generation[47] and agreement on the correct grid connection codes for the MSs in order for the work to be carried out on even conditions.

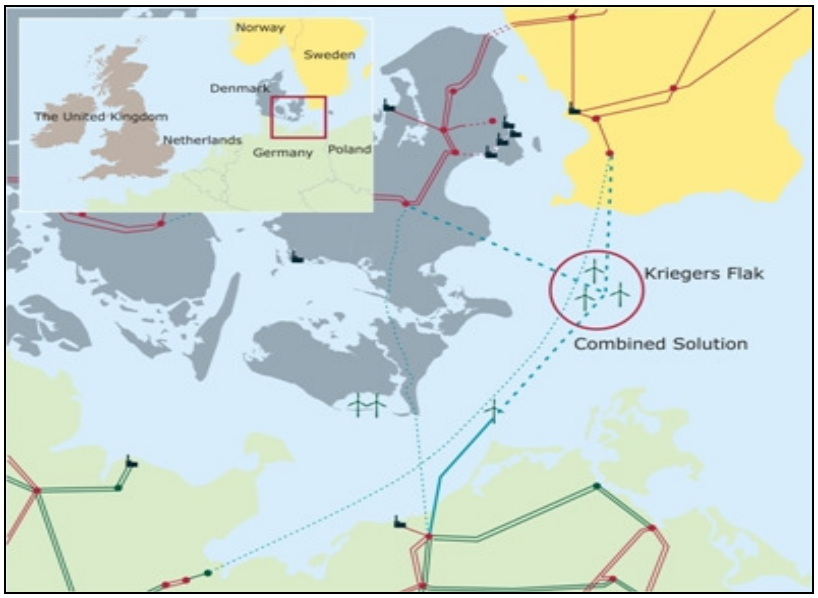

Figure 5: Illustration of potential offshore grid connection at Kriegers Flak

Source: Energinet.dk

5.2.2. The North Sea offshore grid project

Given Europe's wind resources in the North Sea and the reservoir capacity of the hydro-power plants in the Nordic countries, there may be significant potential for an offshore network to connect national networks in North-West Europe and to link up to 70GW of offshore wind projects from Ireland, the UK, Norway, Germany, Denmark and the Benelux countries.

[47] For example, the regimes in Denmark and Sweden have financial incentives and/or penalties for wind generation to balance their output, while Finland does not. Norway has not yet fully developed its regime for offshore wind generation.

A key priority for the European Commission is the development of a "blueprint", expected mid-2010, to highlight particular issues associated with the development of this project. For NRAs, the fact that there are no specific monopoly players tasked with building the offshore transmission grids in some of these countries may be an issue[48]. While the intention behind this is to allow for increased competition in building these networks, consideration may need to be given to getting the appropriate balance between organic development by those investing and a long-term strategic view for development. Furthermore, there are rather different markets and network arrangements in place[49] which may affect the trading of electricity across the network and the incentives wind generation has to connect to the MSs. While many of these issues can be rectified, even in the absence of full harmonisation (for example, with respect to GCTs), these differences may create tensions and affect the incentives generators face.

5.2.3. The Mediterranean Energy Ring

The idea behind the Energy Ring is to complete the missing links with the Southern Mediterranean through electricity (and gas) interconnections, including key projects important for diversifying the EU's external energy supplies in further away regions, such as future links from Iraq, the Middle East and Sub-Saharan Africa (see Figure 6). In particular, the ring may be of essential importance to develop the region's vast solar and wind energy potential.

Similar to Kriegers' Flak and the North Sea offshore gird, the Mediterranean Energy Ring has received considerable political backing[50]. It was highlighted in the Commission's 2nd Strategic Energy Review and a Communication from the Commission in 2010 is expected on the matter, in which it will set out its further thoughts on the project.

Certain issues associated with the project include handling interconnections with transmission, managing non-synchronised areas and possible synchronisation and ensuring compatibility, or possible harmonisation, with the market and network arrangements among European MSs and North Africa.

[48] For example, in Great Britain, third parties will tender competitively to build the offshore grid; in Ireland (and elsewhere), independent parties are free to act as merchant interconnectors in connecting the national grids of different countries.

[49] For example, in Germany and Denmark the cost of grid reinforcement is wholly paid for by the TSO/DSO while in Ireland, Great Britain and Norway (among others) the generator is required to also contribute to some of this cost. Similarly, the cross-border gate-closure times vary across MSs.

[50] Though progress on research and funding is some-what behind the other projects.

Figure 6: Conceptual figure of the Mediterranean Energy Ring
Source: Eurelectric

5.2.4. Role of the Regional Initiatives

To facilitate the development of these projects, the relevant NRAs need to discuss and coordinate the specific issues associated with each project. The European energy regulators' Regional Initiatives[51], which has as its purpose to speed up the integration of Europe's national energy markets, could play a very important role in enabling this, particularly where the scope of the project fits well with a regional initiative region.

[51] For further information, see http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_INITIATIVES

6. Conclusions and next steps

At this stage, it can be concluded that the coming expansion of wind generation will interact with many aspects of the regulatory framework and regulators recommend that the implications are fully considered as new policies are developed. This consultation is intended to help identify the issues and, through responses, pull together stakeholder views and recommendations. CEER envisages developing more detailed conclusions and recommendations following the consultation. At the same time, regulators recognise that wind is one form of low-carbon generation and do not intend for this report to distract from the important debates relating to other types of generation.

Given the wide scope of the issues considered and depending on the feedback received from stakeholders, it seems likely that these issues will need to be, or could be, reflected through several future work streams for the European energy regulators, such as,

- Development of the framework guidelines on network connection, capacity allocation and congestion management and balancing[52];
- Advice on and assessment of the Community-wide ten-year electricity network development plan to be produced by ENTSO-E;
- Work on smart grids and smart meters; and
- Consideration of appropriate incentives for TSO system operation and requirements set in the Regulation (EC) 714/2009 for adopting common network operation tools to ensure coordination of network operation and for adopting research plans .

In addition, CEER intends to undertake a further assessment of the implications and implementation of the Climate and Energy Package in late 2010[53], once the initial action plans are available. And regulators will continue to engage with a wide range of other projects and discussions.

CEER hopes that those stakeholders with a particular interest in the wind generation (and other renewables) sector will participate actively in the consultation. European energy regulators also welcome feedback from groups that are developing and discussing developments in the internal electricity market, such as the Florence Forum. It is no longer practical to consider renewables and electricity markets as two separate topics – it is essential to consider their interaction and to promote the integration of renewable generation in the wholesale electricity market. Feedback from consumer groups and other stakeholders is also welcome.

Finally, regulators note that these issues are not exclusive to Europe. CEER will therefore take a leading role in the assessment of best practices in accommodating renewables and distributed generation conducted under the auspices of the International Confederation of Energy Regulators (ICER).

[52] In this context, a relevant topic within market design issues is the GCT. It may be preferable for wind generation to have a GCT closer to real-time. This may help encourage further market participation by wind generation and reduce system balancing costs.

[53] As provided for in the CEER Work Programme for 2010.

Annex 1 – CEER

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. 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 CEER and ERGEG are intrinsically linked.

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 Sustainable Development Task Force, with assistance from the Energy Networks and Markets Task Force, under the Electricity Working Group.

Annex 2 – List of abbreviations

Term	Definition
BRP	Balancing Responsible Parties
CEER	Council of European Energy Regulators
DSO	Distribution System Operator
ENTSO-E	European Network of Transmission System Operators for Electricity
ERGEG	European Regulators Group for Electricity and Gas
GCT	Gate-closure time
NRA	National Regulatory Authority
MS	Member State
R&D	Research and Development
TSO	Transmission System Operator

Table 1 – List of Abbreviations

Annex 3 – Summary of regulatory arrangements by MS

Table 2 – Summary of network, market and regulatory framework, by MS[i]

		AUSTRIA	BELGIUM	CYPRUS	CZECH REPUBLIC	DENMARK	ESTONIA	FINLAND	FRANCE	GERMANY	GREECE	HUNGARY	IRELAND	ITALY	LATVIA[ii]	LITHUANIA	LUXEMBOURG	NORWAY[iii]	POLAND	PORTUGAL[iv]	ROMANIA	SLOVAK REPUBLIC	SLOVENIA	SPAIN	SWEDEN	THE NETHERLANDS	GREAT BRITAIN
Priority connection for wind																											
	On-shore	x	✓	✓	✓	✓	x	x	x	✓	x	x	x	✓	x	✓	x	x	x	x	x	x	x	✓	x	✓	x
	Off-shore	-	✓	-	-	x	x	x	x	✓	x	-	x	✓	-	-	-	-		-	-	-	-	✓	x	✓	x
Different charging regime for connection of wind																											
	On-shore	x	✓[v]	✓	x	✓	x	x	x	x	x	x	x	✓	x	x	x	x	✓	x	x	x	x	x	x	x	x	x
	Off-shore	-	✓	-	-	✓	x	x	x	x	x	-	x	✓	-	-	-	-	✓	-	-	-	-	x	x	x	x	x
Obligation on the TSO to provide connection to wind																											
	On-shore	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Off-shore	-	✓	✓	-	x	✓	✓	✓	✓	✓	-	✓	✓	-	-	-	-	✓	-	-	-	-	✓	✓	✓	x

		AUSTRIA	BELGIUM	CYPRUS	CZECH REPUBLIC	DENMARK	ESTONIA	FINLAND	FRANCE	GERMANY	GREECE	HUNGARY	IRELAND	ITALY	LATVIA	LITHUANIA	LUXEMBOURG	NORWAY	POLAND	PORTUGAL	ROMANIA	SLOVAK REPUBLIC	SLOVENIA	SPAIN	SWEDEN	THE NETHERLANDS	GREAT BRITAIN
Different charging criteria for wind compared with conventional generation																											
	On-shore	x	✓[vi]	✓	x	x		x	x	x	✓	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	x
	Off-shore	-	✓	-	-	x		x	x	x	✓	-	x	x	-	-	-	-		-	-	-	-	x	x	x	x
Total cost of network reinforcement paid by (wind) generator							✓					✓			✓		✓					✓		✓	✓		
Part of the cost of network reinforcement paid by generator		✓			✓				✓				✓			✓		✓									✓
Total cost of the network reinforcement paid by the TSO			✓	✓		✓		✓		✓	✓			✓					✓	✓	✓		✓			✓	

		AUSTRIA	BELGIUM	CYPRUS	CZECH REPUBLIC	DENMARK	ESTONIA	FINLAND	FRANCE	GERMANY	GREECE	HUNGARY	IRELAND	ITALY	LATVIA	LITHUANIA	LUXEMBOURG	NORWAY	POLAND	PORTUGAL	ROMANIA	SLOVAK REPUBLIC	SLOVENIA	SPAIN	SWEDEN	THE NETHERLANDS	GREAT BRITAIN
Distinct regulatory regime for off-shore investments		-	x	-	-	✓	x	x	x	x	x	-	x	x	-	-	-	-	x	-	-	-	-	x	x	x	✓
Incentive/RoR for network R&D																											
	On-shore	x	x	x	x	x	✓	x	x	x	x	x	x	x	x	X	x	x	x	x	✓	✓	x	x	x	x	x	✓
	Off-shore	-	x	-	-	x	✓	x	x	x	x	-	x	x	-	-	-	-	x	-	-	-	-	x	x	x	x
Explicit priority dispatch of renewables		x	✓	✓	✓	✓	x	x	x	✓	✓	✓	✓	✓	✓	✓	x	x	x	✓	✓	✓	✓	✓	x	x	x
Distinct gate closure for wind compared with conventional generation		x	x	✓	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	✓	x	x	x	x	x	x	x

		AUSTRIA	BELGIUM	CYPRUS	CZECH REPUBLIC	DENMARK	ESTONIA	FINLAND	FRANCE	GERMANY	GREECE	HUNGARY	IRELAND	ITALY	LATVIA	LITHUANIA	LUXEMBOURG	NORWAY	POLAND	PORTUGAL	ROMANIA	SLOVAK REPUBLIC	SLOVENIA	SPAIN	SWEDEN	THE NETHERLANDS	GREAT BRITAIN
Requirement on market players to buy wind generation																											
	On-shore	x	✓[vii]	✓	✓	✓	✓	x	✓	✓	✓	✓	x	x	✓	✓	✓	x	✓	✓	✓	✓	✓	x	x	x	x
	Off-shore	-	x	-	-	x	x	x	x	✓	✓	-	x	x	-	-	-	-	✓	-	-	-	-	x	x	x	x
Compensation for generator in the event of being constrained off																											
	On-shore	x	x	x	x	✓	✓	x	✓	✓	x	x	✓	✓	x	-	x	✓	✓	x	x	x	x	x	x	✓	✓
	Off-shore	-	x	-	-	✓	✓	x	✓	✓	x	-	✓	✓	-	-	-	-	✓	-	-	-	-	x	x	✓	✓
Incentives/penalties on wind generators to balance generation																											
	On-shore	x	✓	x	x	✓	x	x	x	x	x	x	x	x	✓	x	x	✓	x	x	x	x	✓	✓	✓	✓	✓
	Off-shore	-	✓	-	-	✓	x	x	x	x	x	-	x	x	-	-	-	-	x	-	-	-	-	✓	✓	✓	✓

		AUSTRIA	BELGIUM	CYPRUS	CZECH REPUBLIC	DENMARK	ESTONIA	FINLAND	FRANCE	GERMANY	GREECE	HUNGARY	IRELAND	ITALY	LATVIA	LITHUANIA	LUXEMBOURG	NORWAY	POLAND	PORTUGAL	ROMANIA	SLOVAK REPUBLIC	SLOVENIA	SPAIN	SWEDEN	THE NETHERLANDS	GREAT BRITAIN
Role for the NRA in issuing licences to wind farms		x	✓	✓	✓		✓	x	x	x	✓	✓	✓	x	✓	x	x	✓	✓	x	✓	✓	✓	x	x	x	✓
Role for the NRA in resolving disputes between TSO and generators		✓	✓	✓	✓		✓	✓	✓	✓		x	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	x	✓	✓	✓
Sitting of off-shore wind farms																											
	Built outside territorial waters	-	✓	-	-	x		x	x	✓	x	-	x	x	-	-	-	-	x	-	-	-	-	x	✓	x	✓
	Efforts to comply with inter-national law	x	x	x	x	x		x	x	x	x	X	x	x	x	-	x	x	x	x	x	x	x	x	x	x	✓

Source: NRAs.

Indicates information is not available.

[i] Information not available for Bulgaria, Iceland and Malta.

[ii] MS treated as if it does not have offshore wind.

[iii] MS treated as if it does not have offshore wind.

[iv] MS treated as if it does not have offshore wind.

[v] Answer applies only to Wallonia

[vi] Answer applies only to Wallonia

[vii] Answer applies only to Wallonia

Annex 4 – Summary of responses to the questionnaire by issue

Deployment of wind

Out of a possible 29 responses (EU27 plus Iceland and Norway), 27 responses were received– Bulgaria and Malta did not responded. Of these, 25 countries said they have on-shore wind generation (Iceland does not) and 14 countries (Belgium, Denmark, Estonia, Finland, France, Germany, Great Britain Greece, Ireland, Italy, Poland, Spain, Sweden, and the Netherlands) said they have off-shore wind generation or a regulatory framework for the future deployment of off-shore generation. (While some responses said they had off-shore wind generation, answers indicated that they did not have in place a developed regulatory regime for off-shore. They were therefore treated as having no off-shore generation. These countries are Latvia, Norway and Portugal).

Regulatory framework

Role of NRAs

For most of the NRAs, their role in the wind sector extends to granting wind generation licences (Belgium, Cyprus, Czech Republic, Estonia, Great Britain, Greece, Hungary, Ireland, Latvia, Norway, Poland, Romania, Slovak Republic and Slovenia), contributing to the development of the rules for user access and connection, approving the network tariffs that wind generators are subject to and playing a role in the approval of grid investments for wind generators. However, this is usually in line with their role in creating a stable regulatory framework for all generation, rather than being limited to wind.

Most regulators also have a role in resolving disputes between wind generators and the TSO/DSO regarding building or connecting of the grid – just 3 (Hungary, Portugal and Spain) said they did not. In such a circumstance, the matter is resolved by the courts (Hungary) or by the government (Portugal).

However, some regulators have a greater role in wind generation than others. For example, Cyprus has an explicit role to encourage renewable energy sources. Czech Republic, the Slovak Republic and Spain play a role in the design of the support scheme for renewables and in Romania and Great Britain, the NRAs approve the renewable generators which are eligible for support. Belgium (regional authorities), Poland, Romania and Great Britain also issue Guarantee of Origin certificates for renewable energy. None of the NRAs have a specific role in the deployment of off-shore generation, with the exception of Great Britain. Here the NRA administers the tender regime for the off-shore grid, which involves deciding who will be licensed to operate, build and operate the sub-sea transmission lines.

Market arrangements

Dispatch of wind generation

Ten regulatory regimes do not provide for explicit priority dispatch for renewables (Austria, Estonia, Great Britain, Finland, France, Luxembourg, Norway, Poland, Sweden and the

Netherlands). This may be related to the market arrangements. For example in Great Britain, the market arrangements are such that the cheapest generation is dispatched first. Given the low input costs and the subsidy generators receive when producing each unit of renewable energy, renewables usually go first. Priority dispatch is not a rule of the system, but rather a symptom of it.

For those regimes that do provide for explicit priority dispatch for wind generation, none of them provide it exclusively for wind over other forms of generation. For example, Belgium, Cyprus, Germany, Ireland and Italy provide priority dispatch for all renewable generation as defined under the Renewables Directive.

Gate-closure times (GCT) for wind generation

Figure 4 sets out the GCTs, by generation type and Member State. GCTs for wind generation among the regulatory regimes vary between 24 hours to 30 minutes.

Three countries (Cyprus, Latvia and Poland) have different GCTs for wind generation compared with conventional generation. For example, in Poland, the gate-closure for wind generation is one hour but two hours for other types of generation[54].

GCTs for interconnectors and for within the market may differ. For example, Belgium, Cyprus, France and Poland have different GCTs for their interconnectors compared with their own markets.

Balancing of wind generation

Thirteen regimes (Austria, Belgium, Estonia, Finland, Great Britain, Latvia, Norway, Poland, Romania, Slovenia, Spain, Sweden and the Netherlands) require wind generators to balance the energy they commit to supplying with the energy they actually supply. In Romania, wind generators are obliged to balance but do not face financial penalties if they do not. In Portugal, it is the TSO/DSO and the supplier of last resort that pays the financial penalties for imbalance.

With respect to incentives for imbalance, 9 on-shore regimes (Belgium, Denmark, Great Britain, Latvia, Norway, Slovenia, Spain, Sweden and the Netherlands) subject wind generators to financial penalty for imbalance and 6 regimes subject off-shore wind generators to financial penalty for imbalance. In Latvia, larger wind generators (over 15MW) are penalised 20% of the payment from traders if they do not balance. In Slovenia, wind generators that are part of the feed-in support scheme are grouped together for balancing, the cost of which is part of the support scheme. Offshore generators in Belgium are subject to a penalty if their imbalance is more than 30% that first forecasted.

Role of different players in the market arrangements

In 17 of the regimes, there is an obligation on other market players to buy the wind generators' energy. These market players include suppliers (Cyprus, France, Poland, Portugal and

[54] As of December 2009.

Romania), traders (Latvia and Hungary), the market operator (Slovenia) and the TSO/DSO (Czech Republic, Estonia, Germany, Greece, Hungary, Lithuania, Slovak Republic, Slovenia and Wallonia (Belgium)).

With the exception of Denmark, Hungary and Lithuania, all the TSO/DSOs can require wind generators to stop or to reduce their generation. Reasons given relate to security risks and capacity constraints of the grid. In the event of being constrained, 10 regimes (Denmark, Estonia, France, Germany, Great Britain, Ireland, Italy, Norway, Poland and the Netherlands) allow for the generator to be compensated. In Estonia, the compensation relates only to the generators' direct costs; in Germany, compensation amounts to revenue the generator would have received less expenses; and in Italy, compensation is only paid where there is a real-time reduction (rather than a planned reduction, for example).

Network arrangements

Ownership of assets

With respect to who owns which assets on-shore, the most common arrangements are those where the generator owns the wind turbine, the transformer and the cables to the connection point at the main on-shore grid. However, in many of the regimes (for example, Austria, Cyprus, Germany, Norway, Poland, Portugal and Sweden), there is a possibility of having more than one type of asset ownership. In practice, this depends on the type of contract between the generator and the TSO/DSO (Poland), the metering arrangements (Cyprus) and/or the size of the wind park (Austria and Portugal, whereby smaller wind parks own only up to the turbine and the transformer). It is not very common for the grid assets to be owned by third parties (i.e. not the generator or the on-shore TSO/DSO) – just 5 regimes on-shore (Austria, Finland, France, Greece and Norway) have such arrangements in place. These third parties include local authorities (France) or very large consumers (Norway).

Off-shore, the most common arrangement is for the generator to own the wind turbine, the transformer and the sub-sea cables to the on-shore connection point at the main on-shore grid or to “the beach”. This is the case in Belgium, Estonia, Finland, Ireland, Poland (though this depends on the contract in place between the generator and the TSO/DSO), Spain and the Netherlands. France also has these arrangements, but the issue is under consideration. In Denmark, Germany, Greece, Italy and Sweden, the offshore cables are owned by the TSO/DSO.

Connection of wind generation

Eight regimes provide for priority connection of on-shore wind generation over other forms of generation. These are Belgium, Cyprus, Czech Republic, Germany, Italy, Lithuania, Spain and the Netherlands). For off-shore, 5 regimes (Belgium, Germany, Italy, Spain and the Netherlands) provide for priority connection over other forms of generation.

All NRAs agree that there are no overly punitive measures in place which wind generators must adhere to in order to connect. Rather, there were separate technical specifications which wind generators must comply with, due to the nature of their generation.

With respect to the charges for connecting, 5 regimes (Wallonia (Belgium), Cyprus, Denmark, Italy and Poland) provide for different criteria for determining the charges for connecting on-shore wind generation. The criteria for charging connection differs across NRAs – for off-shore wind generation in Belgium, the generator receives a contribution from the TSO/DSO to cover part of the cost of the off-shore cables; in Italy, renewable generation receive a discount on the cost of connecting; and in Poland the charges for connecting renewable are half that of conventional types of generation.

All regimes, with the exception of Norway and Great Britain off-shore, require the TSO/DSO to offer a connection to a wind generator if requested to do so. The obligation to connect other types of generators, however, does not exist in three of these regimes (Belgium, Czech Republic and Slovenia).

Use of system charging

With respect to the charges for use of the transmission and distribution system, wind generators are subject to a different charging regime compared with conventional generation in 4 regulatory regimes (Belgium, Cyprus, Greece and the Slovak Republic). In Cyprus and Greece, renewables generators are not obliged to pay any charges towards use of the system. In Belgium, renewable generators are exempt from certain federal contributions to be paid to government. Belgium also distinguishes on-shore and off-shore generation within its charging regime: in effect, there is a more favourable balancing regime for off-shore generation.

Reinforcement of the grid

With respect to whether wind generators are obliged to pay for grid reinforcement which is necessary as a result of their connection, 12 of the regulatory regimes on-shore (Belgium, Cyprus, Denmark, Finland, Germany, Greece, Italy, Poland, Portugal, Romania, Slovenia and the Netherlands) do not require wind generators to pay anything towards the cost. Meanwhile, 7 of the regimes require the wind generator to pay for some proportion of the reinforcement (Austria, Czech Republic, France, Great Britain, Ireland, Lithuania and Norway) and 7 require them to pay for the total cost of the grid reinforcement (Estonia, Hungary, Latvia, Luxembourg, Slovak Republic, Spain and Sweden). For those regimes that share the cost of reinforcement between the TSO/DSO and the generator, the actual proportion differs – for Cyprus and the Czech Republic, costs are evenly shared; for France and Lithuania, the generator pays 40% of the reinforcement costs and for Ireland and Great Britain, the local costs (defined as shallow connection costs) are paid by the generator while the rest (deep costs, which other generators may be able to benefit from) are paid by the TSO/DSO.

In all regulatory regimes, the criteria for determining costs that wind generators may be subject to as a result of grid reinforcement do not differ according to generation type (though in the Slovak Republic, differentiation of charges will be defined by new legislation that is currently under consideration).

The regulatory regime for the off-shore grid

Only in Denmark and in Great Britain is there a distinct regulatory regime, different from that of on-shore, in place for investments made in the off-shore regime. For example, in Great Britain, the off-shore regime involves the competitive tendering of licences to build, own and operate grid connections, so the rate of return for these projects is not "determined" in the same way that the it is determined for on-shore price controls. Instead, investors bid their required return and the NRA selects the bid that represents the most efficient and economic overall proposal, taking into account, among a range of other factors, the rate of return component bid for by the investor,

Planning the development of the network

In most cases, the TSO/DSO is responsible for the development of the grid, while the NRA monitors and approves the network investment to be made. In Great Britain, Hungary, Italy, Portugal and Spain, the government can also have a role in determining how the network should develop.

Where long-term strategic planning takes places, the length of the forecast varies: in Greece, it is 5 years ahead; in the Netherlands and Great Britain, it is 7 years; and in Cyprus and Romania, it is 10 years.

Authorisation of wind generators

In 10 regulatory regimes (Cyprus, Greece, Hungary, Ireland, Lithuania, Portugal, Romania, the Slovak Republic, the Netherlands and Spain), wind generators can be refused a licence to establish themselves. Responsibility for this varies between the government (Slovak Republic), the TSO/DSO (Hungary, Romania) and the NRA (Hungary). Reason for refusal usually relates to safety reasons – the grid would be unable to cope with increased supply on the system, so new generation is refused. However in Cyprus, wind generation may be refused a licence if applications for renewable generation exceed the subsidies provided for under a special RES fund. In Hungary, only wind generation, and not other types of generation, can be refused a licence. Where there is such a limit on the connection of generation, 8 regimes (Cyprus, Greece, Hungary, Lithuania, Norway, Portugal, Slovak Republic and Spain) have a specific tender process for allocating capacity on the network for on-shore generation and 5 regimes have one for off-shore generation (Belgium, Denmark, Spain, Greece and Great Britain). This could be a tendering process (Greece and Portugal) or through a first-come, first-served process (Slovak Republic). In Ireland, connections for renewables are allocated through the “group processing approach”.

Research and Development (R&D) funding for the grid

On-shore, five regulatory regimes (Estonia, Great Britain, Ireland, Romania and the Slovak Republic) provide for a specific return or incentive for the TSO/DSO to engage in R&D practices. None of these are specifically related to wind generation. In Estonia, the regulatory regime recognises investments that are necessary for raising the efficiency of the activities of the company in order to ensure security of supply and environmental protection. This applies to both on and off-shore activities. In Ireland, Romania and the Slovak Republic, R&D is part of the

justified costs of the TSO/DSO; however it is subject to review by the regulator. On-shore in Great Britain, there is an incentive in place for R&D projects that conform to industry guidelines of good practice.

Sitting of off-shore wind farms

Of the countries with off-shore wind generation, 4 (Belgium, Germany, Great Britain, Sweden) have them built outside of the country's coastal territorial waters. Of these, regulators are only aware of the arrangements to comply with international law for one MS, Great Britain.

Annex 5 – Summary of other studies on the integration of wind generation

- Adequate intraday market design to enable the integration of wind energy into the European power systems, Christoph Weber, 2009. Available at: www.elsevier.com

  This paper analyses the market designs of France, Germany, Scandinavia, Spain and the UK with respect to their aptitude to absorb large amount of wind energy. The paper suggests that wind energy will particularly benefit from increased liquidity in the within-day markets, once power operators are responsible for the schedule deviations they are causing. The paper looks at the design of within-day markets and suggests that Spain's seems to be the most attractive way of increasing liquidity. However, the paper cautions against creating inconsistent incentives for traders active in both within-day and day-ahead markets.

- Development of balancing in the Internal Electricity markets in Europe, K. Verhaegen, L Meeus and R.Belmans. Available at: http://www.leonardo-energy.org/webfm_send/738

  This paper discusses the state of balancing management in Europe, and argues that there is a lot of potential for organising balancing across control zones. It also looks at the issue of who should bear the cost of integrating wind generation into the market arrangements, concluding that wind generation should have the incentive to follow their submitted generation schedules as much as possible. The necessary harmonisation and coordination among TSOs is also discussed.

- Pros and Cons of exposing renewables to electricity market risks – A comparison of the market integration approaches in Germany, Spain and the UK, Klessman, 2008. Available at: www.elsevier.com

  This paper examines how renewable energy is integrated into the electricity market under both support legislation and the regulatory framework of Germany, Spain and the UK. The analysis shows that the 3 counties follow contrasting approaches – risk exposure is highest in the UK and lowest in Germany. The paper argues that the special characteristics of wind energy put natural limits to the response of wind power plants to market prices and locational price signals and that these interdependencies should be recognised in the design of the policies and market regulations.

- Variability of wind power and other renewables – management options and strategies, IEA, 2005. Available at: http://www.iea.org/papers/2005/variability.pdf

  This paper investigates whether there are technical limits to the market penetration of renewable energy technologies. It concludes that there are a number of measures necessary to integrate wind energy and other renewables: geographical aggregation of generation, such as wind turbines, reduces the volatility of output, improved forecasting methods make it more predictable and careful attention needs to be paid to reserve. The paper argues that the extent of wind integration is an economic question.

- Large-scale wind power in European electricity markets: Time for revisiting support schemes and market designs?, C.Hiroux, 2009. Available at: www.elsevier.com

This paper questions whether the current support schemes and electricity market designs are well-suited to host a significant amount of wind energy. It argues that more market signals are needed to give the right incentives for reducing wind integration costs but that these should not undermine the effectiveness of support schemes. It also argues that an adequate sharing of costs responsibility between the system operator and wind power producers can help to control wind integration costs.

- Distribution of costs induced by the integration of RES-E power. Rudiger Barth, 2008. Available at: www.elsevier.com

  This paper focuses on the distribution of costs induced by the integration of renewable energy sources. It argues that while economic efficiency recommends that clearly attributable grid connection ("shallow") as well as ("deep") grid costs are charged to the corresponding RES-E producer, deep integration costs should be updated to reflect evolving scarcities and that regulating costs should reflect actual scarcity.

- Regulation and other solutions for the optimal integration of variable RES/DG electricity in the systems of Europe, RESPOND, Intelligent Energy Europe, September 2009.

  This report recommends solutions and regulatory changes necessary for the optimal integration of large shares of intermittent RES-E/DG. These include the introduction of shallow connection charges, the socialisation of grid reinforcement costs for all network users, to allow wind forecasts to be reflected in reserve requirements, to have explicit innovation incentives in network regulation, to have increased market-based management and shorter GCTs.

- How wind variability could change the shape of the British and Irish electricity markets: Summary report, July 2009. Pöyry. Available at: http://www.ilexenergy.com/pages/documents/reports/renewables/Intermittency%20Public%20Report%202_0.pdf

  This report predicts how the markets will change in response to increases wind generation.

Annex 6 – References

Adequate intraday market design to enable the integration of wind energy into the European power systems, Christoph Weber, 2009. Available at: www.elsevier.com

Assessment and optimisation of renewable energy support schemes in the European electricity market: Final report, Intelligent Energy Europe, February 2007. Available at: http://ec.europa.eu/energy/renewables/studies/doc/renewables/2007_02_optres.pdf

Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions, Second Strategic Energy Review: An EU Energy Security and Solidarity Action Plan. Available at: http://ec.europa.eu/energy/strategies/2008/2008_11_ser2_en.htm

Development of balancing in the Internal Electricity markets in Europe, K. Verhaegen, L Meeus and R.Belmans. Available at: http://www.leonardo-energy.org/webfm_send/738

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

Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF

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. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0001:0014:EN:PDF

Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0015:0035:EN:PDF

Distribution of costs induced by the integration of RES-E power. Rudiger Barth, 2008. Available at: www.elsevier.com

EU Action to promote offshore wind energy: Report on the Public Consultation April-June 2008. European Commission. Available at: http://ec.europa.eu/energy/renewables/consultations/doc/2008_06_20_offshore_wind_consultation_report.pdf

European Coordinator's first annual report: Connection to offshore wind power in Northern Europe (North Sea-Baltic Sea), October 2008. Available at: http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2008_off_shore_wind_annual_report_2007_2008_en.pdf

European Wind Integration Study (EWIS) Towards a Successful Integration of Wind Power into European Electricity Grids: Final report, 2007. Available at: http://www.wind-integration.eu/downloads/library/EWIS-phase-I-final-report.pdf

Factors influencing the likelihood of regulatory changes in renewable energy policies, June 2006. Paolo Agnolucci. Available at: www.elsevier.com

Government White Paper on Energy: Delivering a Sustainable Energy Future for Ireland, The Energy Policy Framework 2007-2020, Department of Communications, Marine and Natural Resources, March 2007. Available at: http://www.dcenr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm

Harmonisation of gate-closure times: A report prepared for the Central West Europe Regulators, August 2007. Frontier Economics. Available at: http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_INITIATIVES/ERI/Central-West/Meetings1/RCC_meetings/6th_CW_RCC/DD/Gate%20closure%20report%20-%20updated%20finalv1.0.pdf

How wind variability could change the shape of the British and Irish electricity markets: Summary report, July 2009. Pöyry. Available at: http://www.ilexenergy.com/pages/documents/reports/renewables/Intermittency%20Public%20Report%202_0.pdf

Large scale integration of wind energy in the European power supply: analysis, issues and recommendations, 2005, EWEA. Available at www.ewea.org

Large-scale wind power in electricity markets, Editorial, 2009. Available at: www.elsevier.com

Large-scale wind power in European electricity markets: Time for revisiting support schemes and market designs?, C.Hiroux, 2009. Available at: www.elsevier.com

Managing variability: A report to the WWF-UK, 24 June 2009. David Milborrow. Available at: http://www.foe.co.uk/resource/briefing_notes/managing_variability_jul09.pdf

Market design for a large share of wind power, Editorial, 2009. Available at: www.elsevier.com

Market Simulation of Renewable Electricity in the EU: What degree of harmonisation of support mechanisms is required? Antonio Pflüger, 2005. Available at: www.ceps.eu

“Modelling dynamic constraints in electricity markets and the costs of uncertain wind output, Cambridge Working Paper in Economics”, Musgens and Neuhoff, 2006. Available at: http://www.dspace.cam.ac.uk/handle/1810/131648

Pros and Cons of exposing renewables to electricity market risks – A comparison of the market integration approaches in Germany, Spain and the UK, Klessman, 2008. Available at: www.elsevier.com

Regulation and other solutions for the optimal integration of variable RES/DG electricity in the systems of Europe, RESPOND, Intelligent Energy Europe, September 2009. Available at: http://www.respond-project.eu/

Renewable Energy Policy Review: Ireland, EREC, Available at: http://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES2020/IRELAND_RES_Policy_Review_09_Final.pdf

Single electricity market Wind generation in the SEM: Policy for large-scale, intermittent non-diverse generation, Discussion Paper, CER, 11 February 2008. Available at: www.cer.ie

Strategic Research Agenda: Market Deployment Strategy, from 2008 to 2030. European wind energy technology platform. Available at: http://www.windplatform.eu

Variability of wind power and other renewables – management options and strategies, IEA, 2005. Available at: http://www.iea.org/papers/2005/variability.pdf