Implications of Non-harmonised Renewable Support Schemes

A CEER Public Consultation Document

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INFORMATION PAGE

Abstract

This public consultation document (C11-SDE-25-04) examines the Implications of Non-Harmonised Renewable Support Schemes.

The consultation document addresses the existing differences between national support schemes in Europe and other areas of non-harmonisation in electricity markets. The paper consults on the impact these differences may have on investment decisions and on the functioning of national and European wholesale electricity markets.

Following the consultation, CEER will elaborate a conclusions document incorporating stakeholders' responses. This conclusions paper may feed into regulators' further work in this area and, at a later stage, the European Commission's progress report required by the Renewables Directive, due by 31 December 2014.

Target Audience

Energy suppliers, traders, gas/electricity customers, gas/electricity industry, consumer representative groups, network operators, Member States, academics and other interested parties.

How to respond to this consultation

Deadline: **6 January 2012**

This public consultation is carried out through a dedicated online questionnaire on the European energy regulators' website. To participate in the consultation, please go to:

http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/OPEN%20PUBLIC%20CONSULTATIONS/Non%20harmonised%20RES/LR

and fill in the login request form. You will be provided with a login and technical instructions for the questionnaire.

If you have any queries relating to this consultation document or the online consultation, please contact:

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

Treatment of Confidential Responses

In the interest of transparency, CEER:

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;

ii) requests that any respondent requesting confidentiality submit those confidential aspects of their response by marking them as "confidential" in the dedicated online questionnaire. CEER will publish all parts of responses that are not marked confidential.

For further information on CEER's consultation rules, see CEER Guidelines on Consultation Practices[1].

Related Documents

CEER documents

- "Regulatory Aspects of the Integration of Wind Generation in European Electricity Markets ", A CEER Conclusions Paper, 7 July 2010, Ref. C10-SDE-16-03, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Electricity/2010/C10-SDE-16-03_CEER%20wind%20conclusions%20paper_7-July-2010.pdf

- "CEER Report on Renewable Energy Support in Europe", CEER, 4 May 2011, Ref. C10-SDE-19-04a, http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Electricity/2011/C10-SDE-19-04a_RES_4-May-2011%20final.pdf

External documents

- "Support Schemes for Renewable Energy. A Comparative Analysis of Payment Mechanisms in the EU", EWEA, May 2005, http://www.ewea.org/fileadmin/ewea_documents/documents/projects/rexpansion/050620_ewea_report.pdf

- "A European-wide harmonised tradable green certificate scheme for renewable electricity: is it really so beneficial?", Pablo Del Río, Energy Policy 33 (2005) pp. 1239-1250.

- Communication from the Commission: "The support of electricity from renewable energy sources", 7 December 2005, COM(2005) 627 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0627:FIN:EN:PDF

[1] http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Founding%20Documents%20and%20Rules/Founding%20Documents/E07-EP-16-03_PC-Guidelines_CEER.pdf

- Commission staff working document: "The support of electricity from renewable energy sources. Accompanying document to the Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources," 23 January 2008, SEC(2008) 57, http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf

- Commission staff working document: "Impact Assessment. Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020", European Commission, 23 January 2008, SEC(2008) 85, http://ec.europa.eu/transparency/regdoc/rep/2/2008/EN/2-2008-85-EN-1-0.Pdf

- "Harmonisation of support schemes. A European harmonised policy to promote RES-electricity – sharing costs &benefits", futures-e, Frauenhofer ISI, December 2008, http://www.futures-e.org/

- "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", http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF

- "Wind Power Integration, negative Prices and Power System Flexibility – An Empirical Analysis of extreme Events in Germany ", Marco Nicolosi, Institute of Energy Economics at the University of Cologne, March 2010, http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Working_Paper/EWI_WP_10-01_Wind-Power-Integration.pdf

- Communication from the Commission: "Renewable energy: Progressing towards the 2020 target", 31 January 2011, COM(2011) 31 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0031:FIN:EN:PDF

- "Review report on support schemes for renewable electricity and heating in Europe", Re-Shaping, January 2011, http://www.reshaping-res-policy.eu/downloads/D8%20Review%20Report_final%20(RE-Shaping).pdf

- "Renewable Energy Policy Country Profiles", Re-shaping, March 2011, http://www.reshaping-res-policy.eu/downloads/RE-SHAPING_Renewable-Energy-Policy-Country-profiles-2011_FINAL_1.pdf

- Communication from the Commission on a Roadmap for moving to a competitive low carbon economy in 2050", 8 March 2011, COM(2011) 112 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0112:EN:NOT

- "Regulatory Design for RES-E Support Mechanisms: Learning Curves, Market Structure, and Burden-Sharing", C. Batlle, I. J. Pérez-Arriaga and P. Zambrano-Barragán, MIT Center for Energy and Environmental Policy Research, May 2011, http://web.mit.edu/ceepr/www/publications/workingpapers/2011-011.pdf

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EXECUTIVE SUMMARY

Background

CEER launched a public consultation on the regulatory aspects of the integration of wind generation in European electricity markets in December 2009. Following the consultation, the conclusions document[2] highlighted that more detailed analysis is needed on the implications of different national renewable generation support schemes on investment decisions and on the national and the European electricity markets.

The aim of this consultation document is to explore some of the effects that the differences between support schemes in Europe may have on investment decisions and on market functioning. The paper presents a number of questions for consultation in order to identify the issues that stakeholders consider most relevant. The conclusions document – incorporating stakeholders' responses – will be published in spring 2012 highlighting the most important issues identified through the consultation process.

What are the effects of differences between support schemes?

This paper considers the differences between support schemes that may exist in Europe and the effects these may have on investment decisions and on the functioning of national and European electricity markets. Renewable support schemes in the EU often pre-date the Renewables (RES) Directive (2009/28/EC)[3] targets and have been developed on a national basis. The independent approach taken to develop RES support schemes has led to different types, structures and levels of support in each country. Furthermore, the fact that the RES Directive sets binding targets at Member State level, as opposed to a regional/EU wide level, has led the majority of Member States to maintain or introduce national support schemes to meet their targets.

The document highlights a number of ways in which support schemes differ from Member State to Member State. One commonly discussed difference is in the support scheme types, e.g. feed-in tariffs, feed-in premiums and green certificate schemes. However, there are several other important ways in which support schemes differ.

Following an analysis of these differences, the report considers the effects the non-harmonisation of support schemes can have, splitting the effects into two main groups.

The first group of effects from non-harmonisation of support schemes is creating incentives for investors to locate generation in certain areas and connect into the networks of certain countries in order to benefit from more attractive schemes. The paper analyses rates of renewable deployment to date to show that this generation may not always be located in the

[2] "Regulatory Aspects of the Integration of Wind Generation in European Electricity Markets ", A CEER Conclusions Paper, 7 July 2010, Ref. C10-SDE -16-03

[3] 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

most economically-efficient area from an EU perspective. This may be, at least partly, a result of a perception of more or less attractive support schemes from country to country.

The second group of effects is on market functioning. Differences between schemes can distort markets to a certain extent and risk creating inefficiencies for market coupling and the move towards a European internal energy market. For example, the different schemes in place can have different effects on the wholesale market price in each country. This may distort efficiency gains of price coupling of national markets.

However, while it is accepted that differentiation of support schemes may have impacts on renewable generation deployment and market functioning, there are a number of other areas of non-harmonisation between national electricity markets that may have similar effects. The present paper looks at some examples of these differences between countries and assesses the locational signals that these provide. This document do not attempt to compare the relative materiality of these other factors compared to non-harmonisation of support schemes but asks stakeholders to provide their view on this issue during the consultation.

The paper then analyses the benefits of retaining the possibility for countries to have different support schemes. For example, the possibility for Member States to structure their support schemes as they wish allows them to cater for the level and type of generation that they want to encourage. The paper also highlights academic literature and previous European Commission positions that have suggested that harmonisation of support schemes may not be as beneficial as previously considered, before other areas of the European electricity market have become more harmonised.

Finally, the paper examines the cooperation mechanisms for support schemes that were introduced under the Renewables Directive 2009/28/EC. These mechanisms have the potential to play an important role in encouraging efficient siting of renewable generation while still allowing differences between support schemes to remain. The paper looks at some examples of countries that are considering the use of these cooperation mechanisms.

Next steps

All interested stakeholders are invited to respond to this public consultation, in particular to the concrete questions listed under section 2 of this document. European energy regulators will evaluate the responses and incorporate them into a conclusions document, to be published in spring 2012.

With this consultation, European energy regulators seek evidence on how support schemes are working within the EU in the context of the low carbon agenda. The conclusions paper will feed into further regulatory work in this area and, at a later stage, into the European Commission’s progress report of the Renewables Directive, due by 31 December 2014.

The publication of this consultation paper is considered timely, given the developing importance of cross-border cooperation with regard to achieving the requirements of the 3rd Energy Package and the coupling of national electricity markets. The increasing importance of cross-border infrastructure as part of projects such as the North Seas Countries Offshore Grids Initiative and the work on investigating the ideas of a European supergrid and electricity highways are also of relevance given the emerging importance of cross-border cooperation.

1 Introduction

1.1 Objectives

This consultation document aims to contribute to the discussion on the impacts of non-harmonisation of support schemes for renewable electricity across the EU. For the purposes of this paper, 'support scheme harmonisation' refers to harmonisation of the **type**, **structure** and **level** of support.

Lack of harmonised support has potentially material implications on investment patterns, on electricity markets and thus, on consumers. The paper explores some of these potential implications and consults on their existence and perceived materiality. The findings of the consultation will help to inform the ongoing debate among stakeholders regarding whether and how renewable support schemes could be harmonised across the EU.

European energy regulators have chosen to focus on support schemes as they are often considered to be the main driver for the development of generation from renewable energy sources (RES). Support schemes have a direct impact on electricity markets and on end-consumers, two key areas for European energy regulators' activities. In this document, regulators examine the impacts of different direct support measures[4], particularly of feed-in tariffs (FITs), feed-in premiums (FIPs) and tradable green certificate (TGC) schemes, as these are the most commonly used and easily quantifiable mechanisms in the EU.

We are conscious, however, that other factors, such as indirect support mechanisms, grid connection and tariffs, balancing regimes, planning and administrative procedures and public acceptance also have important effects on the development of RES at national and EU level. While not in the focus of this paper, we will highlight some of these other factors and consult on their importance compared to support scheme non-harmonisation.

As this work considers the impacts of the lack of harmonisation, we do not weigh up the advantages and disadvantages of harmonising renewable support schemes or present a CEER position on this issue. However, the paper does explore some of the considerations of moving to a more harmonised approach and draws upon academic and European Commission (Commission) material to stimulate discussion of whether harmonisation may be beneficial at this stage. The paper also discusses the use of cooperation mechanisms set out in the Renewables Directive 2009/28/EC (RES Directive)[5] dealing with the potential impacts of non-harmonisation and considers a number of examples where Member States are beginning to investigate their use.

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[4] Currently there are many different types of support for renewable electricity, which can be classified as direct and indirect. Indirect methods of support are not explicit payments or discounts, but rather institutional support tools, such as R&D funding, below cost provision of infrastructure or services and positive discriminatory rules. Direct mechanisms can be classified as explicit and quantifiable payments, grants, rebates or favourable tax rates. Source: "Regulatory design of RES-E support mechanisms. Pricing mechanisms and cost allocation ", presentation by Carlos Batlle at the 1st executive workshop on "Regulation of electricity systems with high penetration of generation based on RES Sources". Florence School of Regulation, 6-8 April, 2011.

[5] 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", http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF

1.2 Background

1.2.1 The legislative context

The European Council conclusions of March 2007[6] set out binding European targets for 20% greenhouse gas emission reduction below 1990 levels and 20% energy consumption from renewable energy sources by 2020 (and the non-binding target of 20% reduction in primary energy use compared to projections for 2020).

To implement these targets, the Commission proposed in 2008 a set of legislation in the EU Climate and Energy Package. The RES Directive 2009/28/EC was one of the proposed acts that emerged with particular relevance to this report. To reach the 20% RES target, this Directive established binding targets for each Member State which were calculated according to each individual Member State's existing RES capacity and relative GDP. A 5.5% increase in renewable capacity on 2005 levels was allocated to all Member States and the remaining increases were shared in proportion to GDP per capita. Some Member States, that already had a high RES penetration, had their targets capped. Each Member State was required to produce a National Action Plan[7] by 30 June 2010, outlining how they were planning to achieve these targets. From 2012, and until 2022, the Commission will report every two years on Member States' progress towards reaching their targets and may also propose corrective actions[8] where necessary.

The Commission has set out its view for the more distant future in the "Low Carbon Economy Roadmap 2050"[9] that looks beyond the 2020 objectives. This defines a plan to meet the EU targets of 80-95% reduction in domestic greenhouse gas emissions by 2050 compared to 1990 levels. In the energy sector, this equates to a 93-99% reduction in greenhouse gas emissions by 2050.

In order to meet the 2020 targets and to set Europe on an appropriate trajectory towards its 2050 emissions reduction objectives, a large amount of investment in RES will be required. However, generally speaking, RES technologies are not yet cost competitive with conventional generation[10]. This has led the majority of Member States to introduce RES support schemes in order to stimulate RES development in order to meet their targets. Renewable support schemes in the EU often pre-date the RES Directive targets and have been developed on a national basis. The independent approach taken to develop RES support schemes has led to different types, structures and levels of support in each Member

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[6] Conclusions of the European Council of 8-9 March 2007, http://register.consilium.europa.eu/pdf/en/07/st07/st07224-re01.en07.pdf

[7] http://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htm

[8] "Review report on support schemes for renewable electricity and heating in Europe", RE-Shaping, January 2011, http://www.reshaping-res-policy.eu/downloads/D8%20Review%20Report_final%20(RE-Shaping).pdf

[9] "Communication from the Commission on a Roadmap for moving to a competitive low carbon economy in 2050", COM(2011) 112 final, 8 March 2011, http://ec.europa.eu/clima/documentation/roadmap/docs/com_2011_112_en.pdf

[10] This is still the case for many RES technologies, although to a lesser extent, when subsidies for conventional generation are taken into account.

State. This document focuses on the implications of this non-harmonisation of support schemes.

Currently, national support schemes promote generation which connects into the electricity network of the same Member State providing the support. However, the RES Directive provides for tools allowing Member States to cooperate with each other (as well as with third countries) to develop RES in return for contributions towards the Member State's RES targets even where the electricity is not connected to the network of the Member State providing the support. These cooperation mechanisms and their possible use are discussed later in this paper.

1.2.2 The European Commission perspective

The Commission set out its position on harmonisation in the 2005 Communication "The Support of Electricity from RES Sources"[11] and in an updated working document of the same title in 2008[12].

The 2005 Communication stated that "*Due to widely varying potentials and developments in different Member States regarding renewable energies, harmonisation seems very difficult to achieve in the short term.*" The Communication also suggested that a move to harmonisation in the short term may disrupt certain markets making it more difficult for them to meet their targets.

In terms of the medium and longer term, the Commission sets out potential advantages and disadvantages of harmonisation in the paper. These are summarised below:

Potential advantages:

- Reduction in costs of meeting the EU targets. However, realising these cost efficiencies would require a better functioning internal energy market and greater interconnection levels;
- Economies of scale resulting from one set of rules applying across the EU;
- Larger and more liquid certificates market, resulting in more stable prices. However, administrative costs of this would have to be analysed; and
- More efficient development of RES in the most resource intensive areas, making RES technologies more competitive.

Potential disadvantages:

- If a TGC scheme was chosen for harmonisation, it would only work if it resulted in the correct certificate prices and penalties. Fluctuations in price could lead to increased investor uncertainty;
- Considerable information requirements to optimise tariffs and keep costs low;

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[11] Communication from the Commission: The support of electricity from renewable energy sources, 7 December 2005, COM(2005) 627 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0627:FIN:EN:PDF

[12] Commission staff working document: The support of electricity from renewable energy sources, 23 January 2008, SEC(2008) 57, http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf

- If a harmonised scheme did not differentiate by technology, dynamic efficiency could be reduced as only the most currently competitive technologies would expand;
- Importers of RES in a harmonised system may not be willing to pay where they do not profit from the local benefits such as employment and diversity of energy supplies; and
- Member States may be unwilling to exceed their targets given the potential for social opposition to RES development for reasons such as visual amenity or cost.

In conclusion to the paper, the Commission suggested that competing national schemes may be considered healthy, at least while harmonisation in other areas of electricity market design develops. Competition could lead to a wider variety of solutions and benefits, and different types of schemes may in fact complement each other.

Rather than harmonisation, the Commission considered that coordination based on the 'two pillars' of cooperation and optimisation would be a more suitable approach in the existing environment. The Commission suggested that cooperation between Member States could lead to sub-harmonisation as a step towards a more pan-European model. The present consultation document presents examples of cooperation between countries such as the joint Norway-Sweden support scheme which will be launched in January 2012[13].

The Commission Communication proposes optimisation of national support schemes in order to ensure cost-effectiveness and the removal of administrative and grid barriers. In addition, the Commission suggests a number of ways to optimise support schemes, such as reducing investment risk, encouraging technology diversity and assessing and ensuring compatibility with the internal electricity market.

The Commission reiterated its position on the advantages and disadvantages of harmonisation in the working document of 2008. It stated that the multitude of support schemes may raise concerns from the perspective of a single market but concluded that "*...it is currently inappropriate to harmonise European support schemes...*" The Commission gave the following reasons for this position:

- There is not sufficient experience of quantity-based and price-based support schemes to decide which would be more efficient at EU level;
- A harmonised system would require well-established systems to be abolished, raising the potential for investor uncertainty;
- It may not be possible to differentiate for different technology types in different Member States with a harmonised scheme; and
- Harmonisation may negate the potential for national schemes to be designed to encourage regional development.

The Commission reiterated its case for increasing coordination based on cooperation and optimisation which should help to achieve the long-term goal of harmonisation.

[13] This joint support scheme is summarised in section 7.1 and addressed in more detail in a case study in Annex 3 of this document.

In the following years, the Commission introduced a number of tools for overcoming some of the potential effects of non-harmonisation. In the annex to the Impact Assessment accompanying the package of implementation measures for the EU's objectives for 2020[14], the Commission explored the potential for guarantees of origin (GOs) as transferable certificates that could be used to share the costs and benefits of RES development amongst Member States. The GOs would act as proof to final customers that a given quantity of generation had been produced from renewable sources. This could help Member States to develop RES in a more cost-efficient manner by allowing RES to be built in the areas with the highest resource potential.

The 2009 RES Directive defined three cooperation mechanisms which in the Commission's view could lead to a more European rather than national perspective towards the development of RES in order to encourage a more cost-effective achievement of the EU RES targets. The three tools are summarised below (more detail on how these tools may be used is provided in the section 7 of this document):

- *Statistical transfer (Art. 6)* – Member States may agree to statistically transfer a specified amount of energy produced from renewable sources from one Member State to another. This amount will be deducted from the RES contributions of one Member State and added to the other's.
- *Joint projects (Art. 7)* – Two or more Member States may finance a RES project jointly thus sharing the costs and benefits (including the RES contributions) of the project. There are also provisions for entering into joint projects with third countries.
- *Joint support schemes (Art. 11)* – Two or more Member States may decide to join or partly coordinate their national support schemes. This will allow a certain amount of energy from renewable sources produced in one Member State to count towards the national targets of another either through a statistical transfer or through an agreed distribution rule allocating contributions accordingly.

The Commission presented in 2011 its Communication "Renewable energy: Progressing towards the 2020 target"[15], focusing on cooperation between Member States and on acceleration of the move towards market integration. The Commission stated its belief that Member States have continued to develop national resources independently, without seeking to reduce costs through cooperation. The Commission analysis estimated that up to 10 billion Euro could be saved annually thanks to a more coordinated approach, achieved through greater convergence of national support schemes.

However, the Commission is currently not promoting harmonisation of support schemes but encourages the use of cooperation mechanisms set out in the RES Directive. The Commission considered that this should facilitate a more pan-European cost efficient exploitation of RES resources. The Communication suggests that this should be aided by the

[14] "Annex to the Commission Impact Assessment accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020, 23 January 2008, SEC(2008) 85, http://ec.europa.eu/transparency/regdoc/rep/2/2008/EN/2-2008-85-EN-1-0.Pdf

[15] Communication from the Commission: "Renewable energy: Progressing towards the 2020 target", 31 January 2011, COM(2011) 31 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0031:FIN:EN:PDF

development of a single energy market which will ensure a level playing field and allow RES producers to compete fairly.

As part of the implementation report of the RES Directive, due in 2014, the Commission is expected to assess the functioning of support schemes and cooperation mechanisms. In addition, it has announced its intention to prepare guidelines for more harmonised reforms and to facilitate further the development of cooperation mechanisms. If considered appropriate, the Commission's report may contain a proposal for corrective actions. In this context, Commissioner Oettinger set up in June 2011 a High-Level Group of Member State representatives on the reform of national RES support schemes.

1.2.3 Academic Literature[16]

The question of the harmonisation of support schemes is under discussion and the possibility for Member States to decide how best to support the development of RES has spurred a debate concerning the most effective support mechanisms and whether European harmonisation would be beneficial.

In the early parts of the last decade, the majority of literature in this area emphasised the economic advantages of harmonisation which at this stage focused on the use of an EU-wide quota system such as TGCs. A number of studies suggested that a harmonised scheme could allow for significant cost savings in the region of 15% compared to national schemes, due to the more efficient use of available resources. Other studies concluded that non-harmonisation of support schemes could lead to under-achievement of national and EU targets.

The middle of the last decade saw a step change in thinking, considering a wider range of different schemes (stimulated partly by the take-up of feed-in schemes in many Member States) and a consideration of the potential disadvantages of, and barriers to, harmonisation in addition to the benefits. It was argued that both feed-in and TGC schemes could be used to serve different purposes and in fact might complement each other. For example, TGC schemes may provide better static efficiency (i.e. supporting the most cost-efficient technology at the present time) but feed-in schemes might be important in promoting technologies not yet developed (i.e. more dynamically efficient). It was also suggested that EU level application of one scheme over the other would not be advisable and that the EU should instead concentrate on increasing the effectiveness and efficiency of existing schemes rather than pushing for harmonisation.

At the same time, a number of studies began to consider other important differences between the electricity market and the regulatory regimes of Member States that could affect the implementation of a harmonised support scheme. Many of these studies argued for a reduction of these differences before the harmonisation of support schemes. Soon after, other studies analysed the previous input assumptions and indicated that the benefits of

[16] A comprehensive overview of academic studies on harmonisation up to 2008 is provided in the report "A European harmonised policy to promote RES-electricity – sharing costs and benefits" within the research project "futures-e", http://www.futures-e.org/.

moving to a harmonised approach might not be as significant as previously considered. Studies also began to investigate some of the benefits of a non-harmonised approach and the potential costs of moving to a harmonised system.

The trend continued with the focus moving towards the importance of developing an EU internal electricity market, to provide the right conditions for the harmonisation of support schemes.

More recently, academic literature has looked at the Commission's position and its policy of encouraging coordination through optimisation and cooperation (rather than by pursuing harmonisation directly), stating that this policy has encouraged gradual convergence of support schemes in terms of their key properties.

Following the introduction of the cooperation mechanisms included in the RES Directive, studies have analysed the potential of these mechanisms to allow Member States to achieve their RES targets in an efficient manner by working in cooperation with other countries. This may be considered as an interim step prior to harmonisation of support schemes.

1.3 Structure of the report

The following analysis presents the main ways in which national support schemes differ and provides theoretical examples of where these differences may occur across borders within the EU. Further, it considers the effect of these differences on the development of RES on a pan-European scale, considering the incentives for investments and the functioning of national and European electricity markets. In addition, the document provides examples of other factors impacting on RES investment decisions and market functioning, such as grid and market design. In reviewing the implications of support schemes and other factors on RES development, the paper also explores some benefits of retaining a non-harmonised approach.

Finally, the paper highlights the potential use of the cooperation mechanisms that have been developed to overcome the possible challenges arising due to non-harmonisation of support schemes. Where possible, the document provides examples to highlight the issues under discussion. Detailed case studies are provided in Annex 3[17] of this public consultation document.

[17] See supporting document Annex 3: Case Studies, Ref: C11-SDE-25-04a.

2 Questions for public consultation

CEER invites all interested stakeholders to respond to this consultation. The deadline for responses is **6 January 2012**).

In particular we are interested in stakeholders' perception as to the respective significance of impacts of non-harmonisation of support schemes compared to the impacts of non-harmonisation in other areas of electricity market design.

CEER welcomes responses setting out any issues considered relevant. In particular, stakeholders are invited to reply to and provide comments on the following non-exhaustive list of questions:

Public consultation questions

Question 1: How significant do you consider the impacts of non-harmonisation of support schemes to be for the development of RES and RES technologies?

Question 2: In comparison, how significant do you consider the impacts of non-harmonisation of factors other than support schemes, explored in this report (or in addition to those explored) to be for the development of RES and RES technologies?

Question 3: Please place the factors of non-harmonisation (whether explored in this report or not) in order of materiality/significance. Please separate non-harmonisation of support schemes into type, level, structure and stability of support as explored in this paper (see table 1).

Question 4: In your view, does this consultation document capture all major implications of non-harmonisation of support schemes? Are there additional impacts on investment decisions, market functioning or any other areas you consider relevant?

3 Support scheme design elements

There are a number of differences in the design and application of support schemes that may lead to non-harmonisation, summarised in the table below and analysed in detail in the following chapters.

	Type of support	
Price-based scheme		Quota-based scheme
	Level of support	
High amount of support provided		Low amount of support provided
	Support provision structure	
Fixed rate over time		Variable rate over time
	History of support	
Long-term		Short term
	Support scheme stability	
Perception of stability		Perception of instability

Table 1: Support scheme design elements

3.1 Type of support

A wide range of direct support schemes for RES technologies are used in the EU. These can be broadly classified as quota mechanisms, price mechanisms and "mixed" mechanisms, representing a combination of price and quota mechanisms. This paper focuses on feed-in tariffs (FITs), feed-in premiums (FIPs) and tradable green certificates (TGCs) as they are the most widely used mechanisms across the EU. TGCs are quota-based mechanisms whereas FITs and FIPs are both examples of price-based mechanisms. Quotas set a certain level of renewable production, and let the market discover the price. Price mechanisms guarantee a certain level of support to renewable producers and allow this price to determine the level of development. Mixed mechanisms consist of centralised competitive auctions that provide an indirect way for FIT price discovery and long-term contracting to reduce risk aversion. Mixed mechanisms will not be considered in detail in this report.

Feed-in tariffs
Feed-in tariffs (FITs) provide a defined payment to generators for the amount of KWh generated over a certain number of years. They offer revenue certainty for producers due to their long-term character (from 10 up to around 30 years) and are not exposed to risk associated with electricity market prices. FITs are useful for technologies beyond the R&D phase that have not yet reached market maturity. They do not place a high administrative burden on regulators and do not create a competitive advantage for incumbent generators given the lower market risk associated. This makes it easier for small generators to operate and compete for RES generation. However, it might be difficult to define the correct tariff levels due to information asymmetry between the regulator and the generators. If the FIT rates are too high, producers benefit disproportionately, reducing economic well-being. If the rates are too low, the desired rates of development may not be achieved.

Feed-in premiums

FIPs are a variant of FITs, providing a fixed or variable 'premium' payment above the wholesale market electricity price to supplement the revenues of a RES generator. Under this system, generators have incentives to adjust their production according to price signals which is not the case with FITs. Price signals are not suppressed for "dispatchable" sources such as biomass, as they can burn more feedstock with higher prices. While wind generators will not be able to act in this manner, they can use FIPs to manage their operations and maintenance properly to ensure electricity production during the most profitable hours.

FIPs can, however, imply higher risk premiums. The feed-in price is not guaranteed (as is the case with FITs) but rather provides additional revenue on top of a fluctuating market price. Depending on the level of the FIP, this could result in more barriers to entry for new developers and give a competitive advantage to vertically-integrated companies who are better positioned to manage the increased risk. In Spain, some renewable technologies are allowed to choose between FITs and FIPs, with the FIP level being more attractive than the FIT in order to hedge the risk of fluctuating wholesale prices.

Tradable green certificates

A tradable green certificate (TGC) scheme is a type of quota system which obliges suppliers to source an increasing volume of their electricity from renewable sources. Suppliers have to present TGCs as proof of sourcing the required volume from renewables to comply with the obligation. This allows competition between suppliers for the certificates setting the certificate price. These TGCs expose generators to the market more than in the case of feed-in schemes and exposes them to two different types of market risk as they trade electricity as well as TGC. It is possible that over-investment in RES leads to low prices for certificates, thus further exposing participants to the market.

Quota systems are considered by some as the most economically efficient mechanism. This assessment is based on the fact that no centralised price setting is required, in contrast to feed-in schemes. Some consider that certificate trading "encourages overall efficiency" and provides flexibility for meeting national targets. Quota obligations do, however, tend to support only the most cost-effective technology in the short term if technology banding is lacking. Another disadvantage is that vertical integration of undertakings can favour long-term contracts, resulting in less TGCs being traded in the wholesale market.

Competitive auctions / tenders

Governments or regulators may hold competitive auctions in which they set the desired amount of RES capacity and tender for the least expensive, most attractive offer through an auction process. The winner of the bid will be offered a long-term contract. This reduces the uncertainty attributed to RES developers while allowing governments and regulators to meet their desired capacity levels.

In parallel to reducing developer risk, auctions are considered to have comparatively low administrative costs and few market entry barriers. In addition, they relieve the regulator of the task of price-setting and instead costs are driven by the market. Competitive auctions are more suitable for relatively mature technologies. Where a technology is less mature, a tender process may not attract any competitors or winning bidders may dramatically underestimate costs. Furthermore, the use of auctions requires a central body to select the generation required and thus 'pick winners' with regard to the technology promoted. It is possible that following the selection of a project to tender, planning or business difficulties lead to problems which may have been avoided through a fully competitive choice of project by the market.

Competitive auctions will not be discussed at length in this paper due to their relatively low relevance in the EU at present. However, as technologies become more mature it is possible that their use will increase for the reasons outlined above.

Use of support scheme types in the EU

Figure 1 summarises the types of support schemes that each Member State uses to support RES.

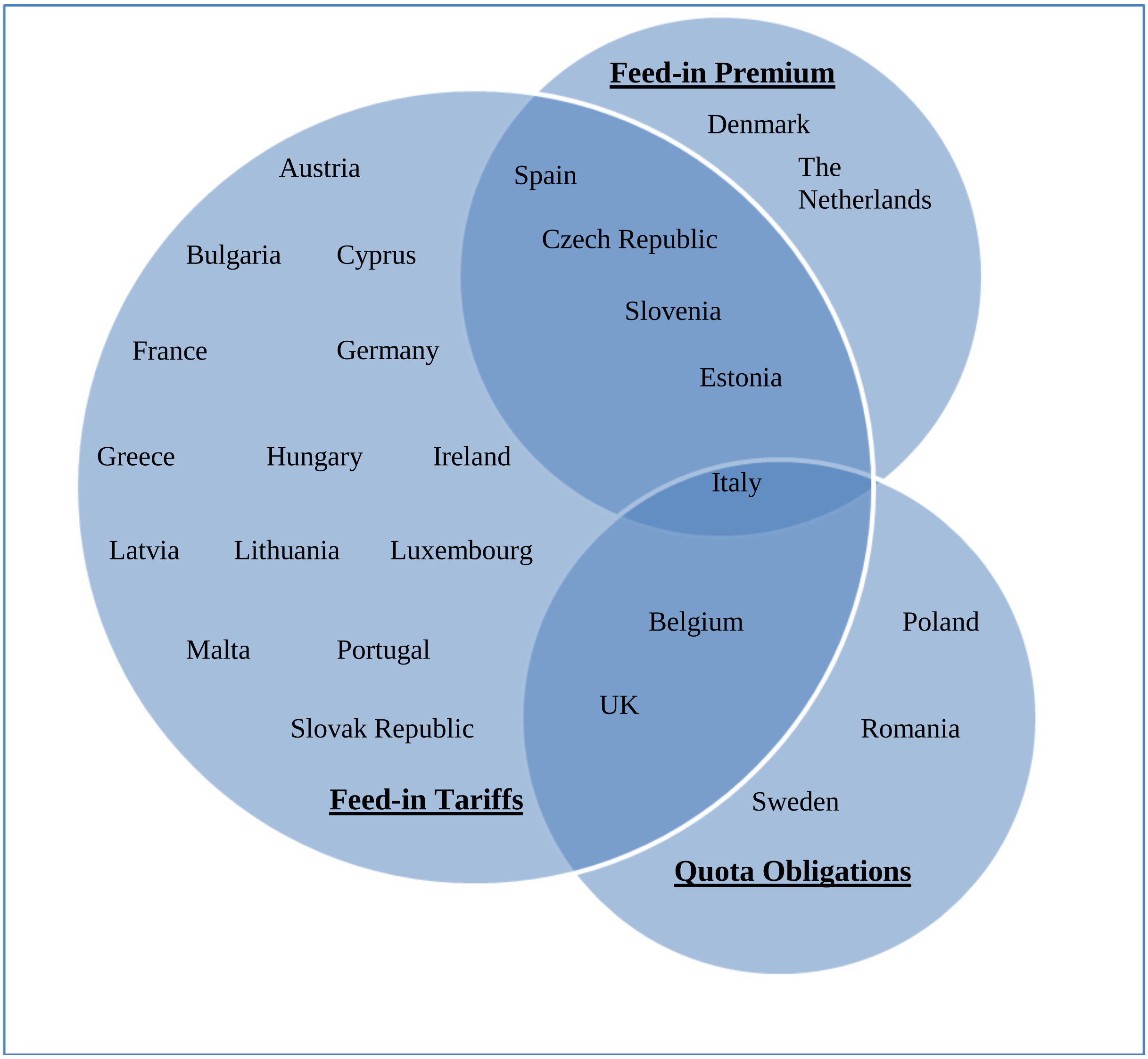

Figure 1: Venn diagram of renewable support schemes in the EU. Source: Adapted from European Commission Report: "Renewable Energy: Progressing towards the 2020 target" January 2011. NB: As of 2012, it will be possible to claim FITs or FIPs in Germany.

Figure 1 shows that FITs are the most popular scheme in the EU. Only six Member States use quota obligation schemes at all and only three of these use quotas without also using some form of feed-in system.

It is possible that one Member State using a feed-in system borders on another that is using a quota system or that two neighbouring Member States use different types of feed-in schemes (e.g. FITs in one and FIPs in another). This may have a number of effects on the market and on investor decisions. These potential effects will be explored later.

3.2 Level of support

The level of support provided varies significantly between Member States and by technology. It is difficult to compare the level of support offered by the different types of support schemes. However, Figure 2 and Table 2 below provide an indicative estimate of the relative weighting attributed to the levels of support provided by the support schemes in each Member State, reflecting the situation in 2009:

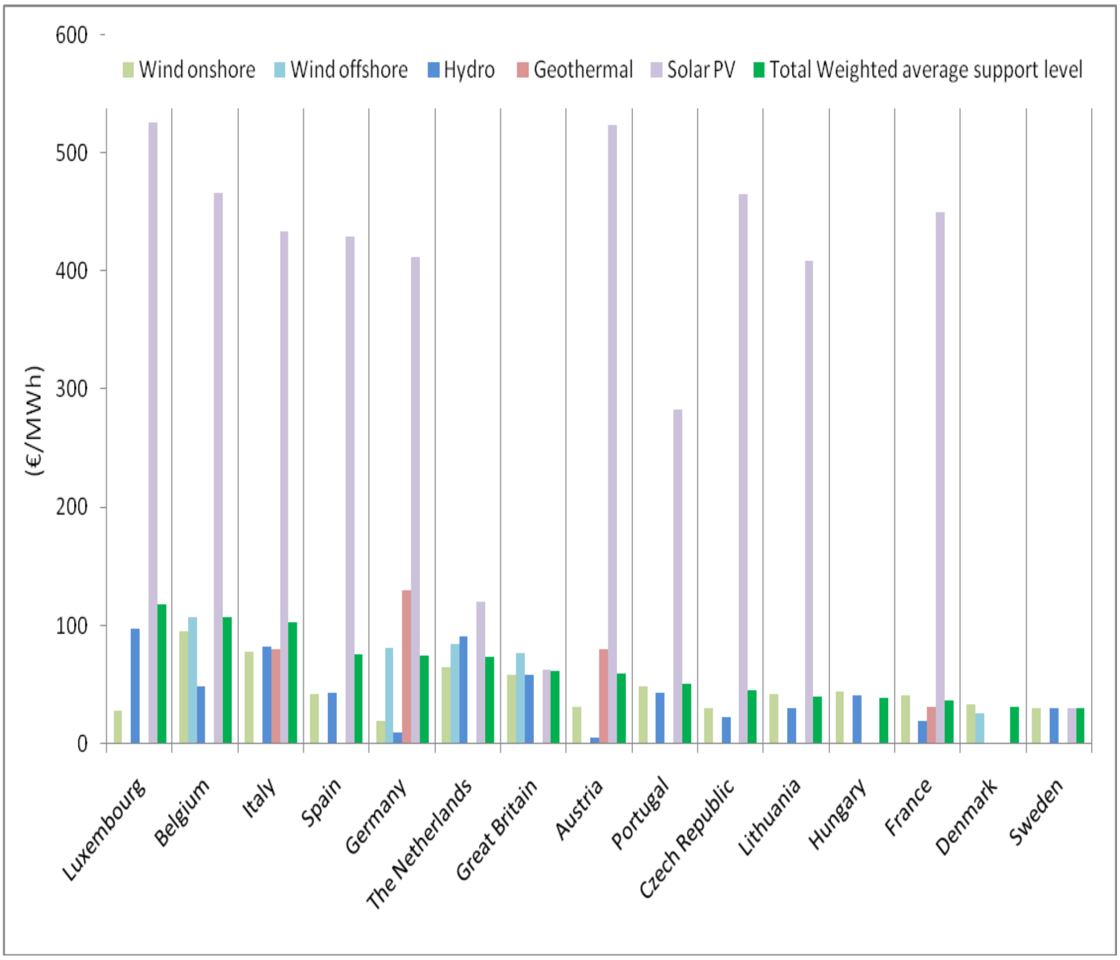

Figure 2: Level of support (in Euro) provided in selected Member States, 2009. Source: CEER

Member State	Weighted average support level (on electricity supported) by technology (€/MWh)					Total (€/MWh)
	Wind onshore	Wind offshore	Hydro	Geothermal	Solar PV	
Austria[18]	31.05		5.05	80.45	523.55	59.71
Belgium	95.28	107.00[19]	48.71		465.39	106.79
Czech Rep.	30.47		22.56		464.32	45.91
Denmark	33.90	25.55				31.21
France	41.48		19.46	31.50	449.97	36.83
Germany	19.14	81.07	9.64	129.79	411.04	74.85
Great Britain	58.78	76.38	58.87		62.59[20]	61.34
Hungary	44.67		40.98			39.07
Italy	77.66		82.03	80.48	432.70	103.00
Lithuania	41.99		30.41		408.10	40.53
Luxembourg	27.98		97.65		525.18	117.97
Portugal	49.11		42.86		282.81	50.57
Spain	42.58		42.78		429.37	76.27
Sweden	30.71		30.71		30.71	30.71
The Netherlands	64.77	84.21	91.49		119.81	73.37
Minimum support	**19.14**	**25.55**	**5.05**	**31.50**	**30.71**	**30.71**
Maximum support	**95.28**	**107.00**	**97.65**	**129.79**	**525.18**	**117.97**

Table 2: RES support levels in a cross section of EU countries, broken down by main technology, 2009. Source: CEER Report on Renewable Energy Support in Europe[21]

Due to the difficulties involved in directly comparing support provided by different types of schemes, the levels of support indicated in the table cannot be 100% accurate. However, the data is accurate enough to support the view that there is a wide range of support provided with an indicative range of the average support offered from €31 to €118.

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[18] In Austria, PV and hydropower projects received investment grants in 2009 amounting to 18 and 20 million euro, respectively. They were not included in the analysis.

[19] For each offshore wind farm, the RES support is composed of the minimum price of green certificates (107 €/MWh for the first 216 MW installed capacity and 90 €/MWh for installed capacity above 216 MW) and an investment aid for the offshore connection cable of max. 25 Mio€, spread over 5 years (5 Mio€/year). The figure of 107 €/MWh does not include the 5 Mio€. Including the amount of 5Mio€, paid for the only offshore wind farm which was operational in 2009, leads to a real expense of 172.41 €/MWh (support of 8.18 Mio€ on green certificates and 5 Mio€ as an investment aid for a total offshore production of 76,435 MWh). This amount of 172.41 €/Mwh is not representative for comparing support levels among different Member States.

[20] In April 2010, a new system of feed-in tariffs was introduced in Great Britain for small-scale RES, which included enhanced support for PV of up to 41.3p/kWh (472 €/MWh using the average April 2010 exchange rate of 1.143 €/£).

[21] The levels of support indicated in the table refer to both overall unit support levels (on supported electricity) and unit support levels broken down by technology. Where different support schemes are in place for the same technology in the same Member State, a weighted average incentive was computed using energy supported for each instrument as weighting.
In order to make support levels of FITs comparable to those of FIPs and TGCs, the incentive part of FIT was estimated by subtracting the electricity wholesale average price from the overall tariff.

3.3 Support structure: Fixed rate and variable rate over time

The flexibility provided by EU legislation allows Member States to design their own support schemes. This has led Member States to structure differently the way in which support is provided over time. In this sense, three different structures can be identified, and are described below.

Support periods set ex ante

A Member State may want to provide stronger incentives for certain RES technologies to be deployed at a certain period of time. Therefore, it may set out ex ante that one type of technology will receive a certain level of support (for the duration of the project) if it starts to generate in a specified period of time while a different level of support is provided to projects which begin to generate in the next specified period of time. This can be used to encourage strongly a less developed technology before reducing the support rate as the market is developing and the technology becomes more cost-competitive.

An example of this structure exists in the UK where banded TGCs, known as renewable obligation certificates (ROCs), are provided at different levels for certain durations. Offshore generation that is granted full accreditation before 31 March 2014 will be provided with two ROCs per MWh. After this date, they will be provided with 1.5 ROCs per MWh.

Periodic review of support scheme levels

An alternative to the approach described above is when the Member State defines ex ante a review of the support levels at regular intervals to decide upon the levels of support provided to new RES installations that will be deployed after a certain date (as opposed to retroactive changes). This gives Member States the flexibility of identifying progress of a certain RES technology and deciding upon the level of support for that technology in the future. The aim is to reduce consumers' risk to pay very high amounts over-supporting a technology while still maintaining a degree of investor confidence through clear upfront timing of the support scheme review (even though the level of support for each period is not known in advance). In Germany, the percentage amount of so-called 'tariff degression', i.e. an annual reduction of the support level for new installations based on expected technological progress, is set by law. A more flexible degression scheme based on capacity build exists for photovoltaic (PV).

Rate varied for the same project over time

A support scheme can be designed in such a way that the support provided to a certain project which begins to feed in electricity at a certain time is set for a fixed duration. Many schemes provide a fixed rate for the project duration, however there are examples where the support provided to an individual project is front loaded and the rate of support declines over the duration of the scheme. In Germany for example, a declining FIT rate over time is provided for offshore wind installations.

This structure is not mutually exclusive from the two previous approaches to structuring how support is provided over time. For example, a Member State can regularly review the support level combined with a degression scheme, i.e. providing higher rate of support in the first few years and lower rates towards the end of the project life. In Germany, the decreasing rate of support applied to individual wind generation projects is defined ex ante, combined with a review of the support level of support provided to that type of generation reviewed at regular intervals.

3.4 Support scheme stability

Investor confidence in a renewable support scheme may be affected by changes by the responsible party in the level or structure of the support scheme, especially where such changes apply retroactively to existing installations. There are a number of ways in which the perceived stability of a support scheme may be affected. The experience with and the history of commitment of a country to RES support may have an effect on the perceived stability of that country's support. In addition, the lifetime of the current scheme in place, the frequency of changes experienced and the way of managing these changes also have an impact.

History of commitment

A European Wind Energy Association (EWEA) study of 2005 analyses the time that a country had a form of RES support in place and the effect this had on RES development. Figure 3 shows for which time period each of the countries involved in the study had had some form of support in place.

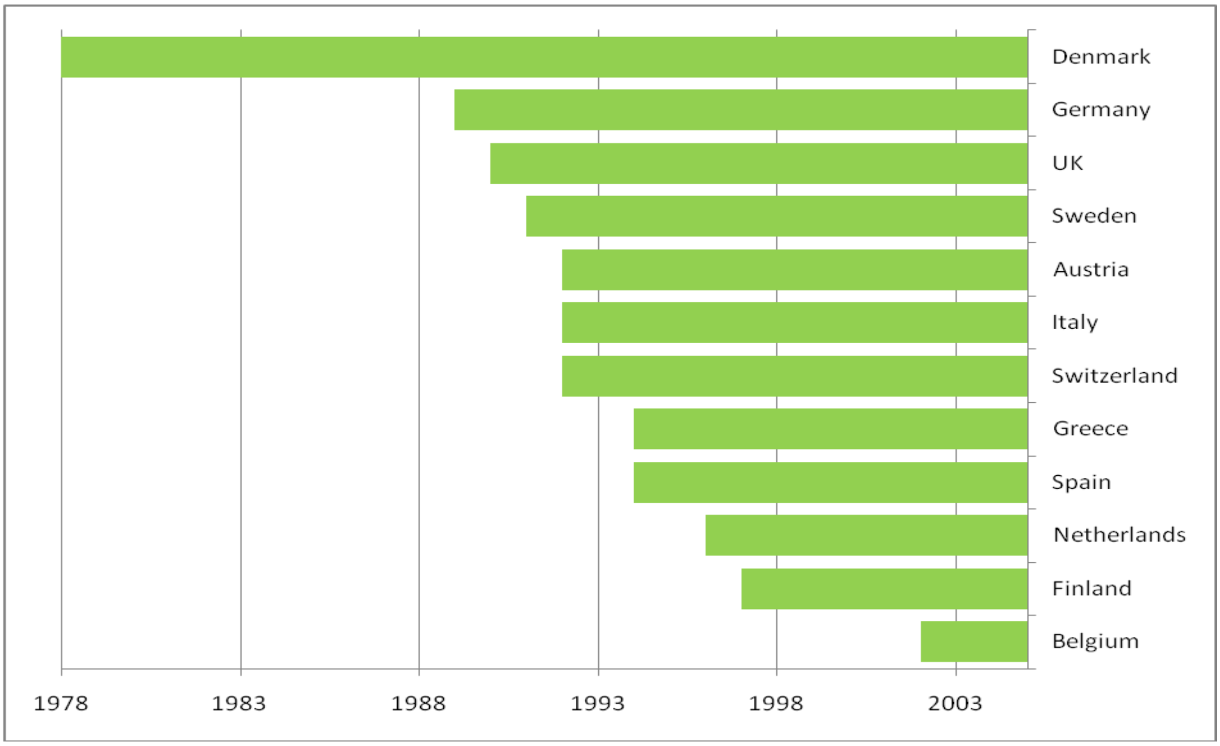

Figure 3: Length of available support across Europe. Source: adapted from EWEA report 2005[22]

The Figure shows that support has been provided for a very long time in Denmark which started to support RES in 1978 in the form of investment subsidies, loans and reduced taxes. After this, regulated tariffs such as FIT and FIP support schemes became more common and more recently quota obligations have emerged.

[22] Support Schemes for Renewable Energy. A Comparative Analysis of Payment Mechanisms in the EU", EWEA, May 2005, http://www.ewea.org/fileadmin/ewea_documents/documents/projects/rexpansion/050620_ewea_report.pdf

Consistency of support schemes

In addition to the length of time that a country has had support in place, it may be useful to consider the stability of the support schemes. A country may not have had a long history of providing support but may have had a consistent scheme in place for the duration of its support scheme history. Conversely, a country with a long history of support may have made many changes to the characteristics of its scheme, such as the type or level of support provided. An overview of the development of RES support schemes is provided in Figure 4 below.

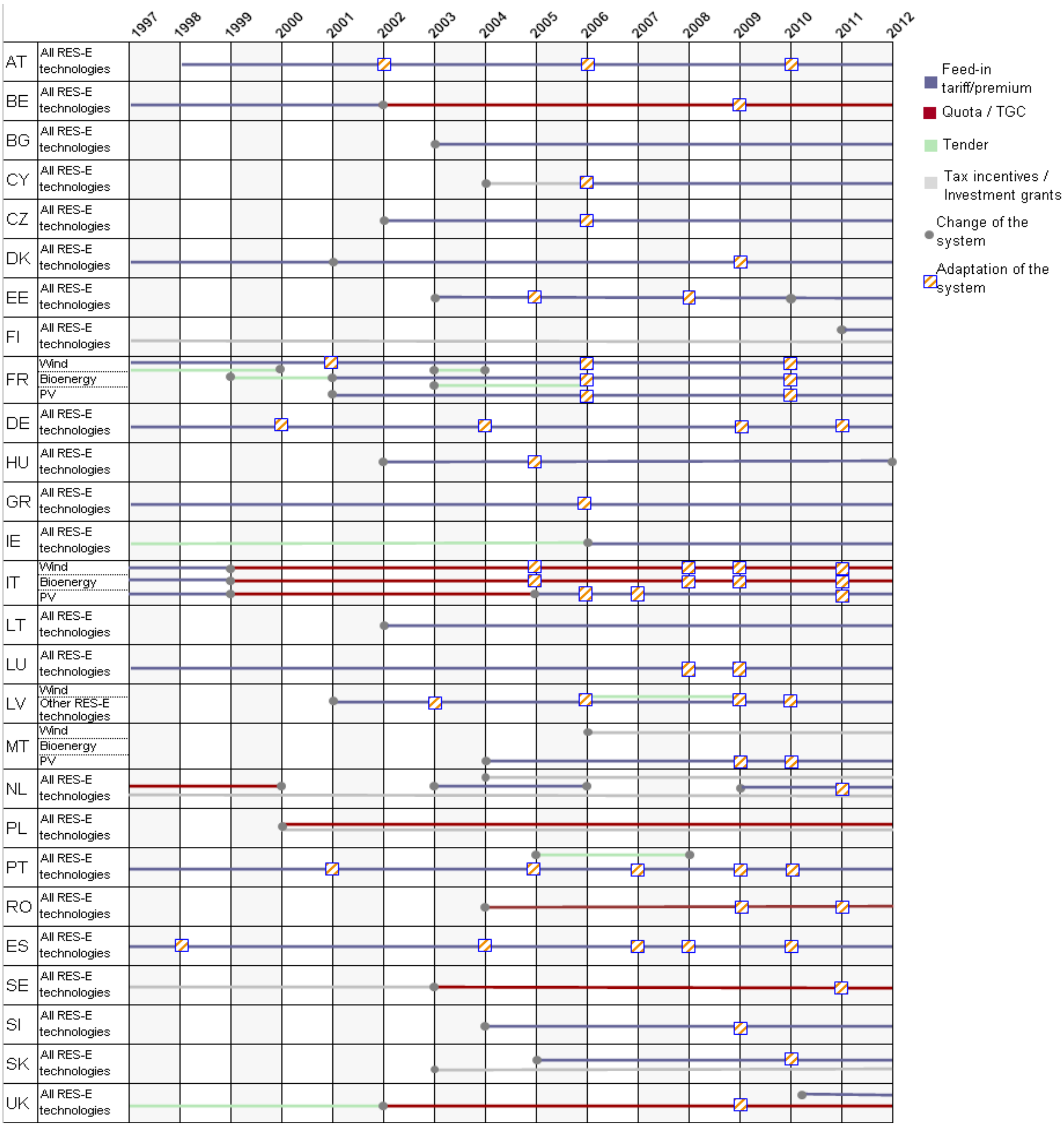

Figure 4: Overview of RES support scheme development. Source: Re-Shaping, 'Renewable Energy Policy Country Profiles' report[23]

[23] Renewable Energy Policy Country Profiles, Re-shaping, March 2011, http://www.reshaping-res-policy.eu/downloads/RE-SHAPING_Renewable-Energy-Policy-Country-profiles-2011_FINAL_1.pdf

The Figure above shows that the majority of support schemes have been adapted or changed a number of times. However, this does not necessarily lead to a substantial reduction in investor certainty where changes are not dramatic, the possibility of change is signaled well in advance and support schemes are grandfathered over time, i.e. changes do not apply retroactively. Germany provides an example of a Member State that has adapted its support scheme four times since 1997 but has retained investor confidence and allowed a strong RES market to develop. This is, at least in part, due to the transparency and light-touch nature of these changes. Until recently, where unscheduled changes have been made to the support conditions for new solar PV, reviews in Germany were scheduled at four year intervals with adaptations to the scheme rarely being made outside of these periods.

Annex 3 of this document describes two case studies where Member States have made significant changes to their support schemes.

Italy had a FIT scheme in 1992 before a TGC scheme was defined in 1999 and became operative in 2002 with the aim of gradually replacing the FIT. A FIP was introduced in 2005 with a specific focus regarding the development of solar PV generation. In addition to the regular introduction of new support schemes, the design of each of these schemes has been revised regularly as shown in Figure 4.

The Czech Republic introduced a FIT scheme in 2001. However, at this time no legally binding framework was in place, meaning the lack of a long-term guarantee for investors to obtain finance from banks. Following its accession to the EU in 2004, the Czech Republic was set a RES target. In order to encourage development, it established a FIT scheme with a 15 year fixed rate and green bonuses providing potentially higher profits than FITs but lacking long-term guarantees. However, the level of support for solar PV encouraged a huge uptake at significant cost to the consumer. This led the Government to retroactively reduce the level of support in 2010 through amendments to the Green Act. It is expected that the Green Act will be revised again in the future to make further changes to the support level offered.

4 Other factors affecting the development of RES

While the non-harmonisation of support schemes may have an impact on the development of RES, it is important to note that there are many other factors that affect RES project costs and risks and may have similar impacts on investment decisions and market functioning. The following section highlights just a few of these factors. The paper consults on the significance of these other factors compared to support scheme non-harmonisation.

Spain provides one example of successful encouragement of RES development, partly because of its favourable support schemes but also because of additional factors. The case study of wind deployment in Spain is considered in Annex 3 of this report. As Figure 6 below shows, Spain has a reasonable amount of wind resource available but this is fairly modest compared to north European countries. However, the case study highlights the high level of deployment and ambitions for wind generation with RES deployment targets for 2010 increasing from 9 GW to over 20 GW between 2005 and 2010.

The Spanish case study shows that this success has been partly a result of a strong and stable support scheme backed by political support. However, there are other positive factors such as the highly developed meshed network and favourable access and connection rules. The TSO plays also an important role by managing the renewable output into the electricity system under safe conditions through a centralised monitoring and control centre (CECRE), wind forecast tools (SIPREOLICO) and continuous network development which facilitates the integration of renewable generation into the system. Some of these additional factors will be explored in the following section.

4.1 Local terrain

In theory, RES would ideally be located where the resource is greatest as the same technology could generate the most electricity. However, the cost of installing the technology and connecting it to the grid will not be the same wherever the generation is located. Where the terrain is particularly difficult (e.g. mountainous regions or far out to sea) the cost of installing the technology and connecting to the grid may increase significantly. Therefore, a better metric for analysing RES deployment efficiency is the resource availability per cost of project development and connection.

4.2 Connection and charging rules

Countries differ in the way they charge generators for connection to and use of the electricity network. There are three main characteristics of the connection rules which can differ:

1. The **level** of charges – Generators are charged for different services and different amounts in each Member State. It is common for generators to be charged for the shallow connection costs, i.e. the costs of connection which can be solely attributed to them (sole-use assets), however not for the deep connection costs, i.e. assets that will be used by multiple parties. However, this is not the case in all countries. For example, in Germany offshore wind generation is not charged for either the shallow or deep connection costs. This may provide a direct incentive for offshore wind generators to locate and connect into the German network, rather than to the network of other Member States.

2. The **time** required to connect to the system – The status of network development and the ability of the TSO to build new infrastructure influences the time necessary for a generator to gain connection to the network and be able to feed in electricity. One of the most fundamental issues in this regard is the connection approach used. Some Member States have a “connect and manage” approach whereby generators are allowed to export their generation as soon as a safe connection is provided even before reinforcements to accommodate the generation are in place. Others have an ”invest then connect” approach whereby the necessary reinforcements must be completed before the generator is allowed to export onto the grid thus creating a “queue” for those awaiting a connection. The “connect and manage” approach is likely to be more attractive to RES generators as it allows new generation to start profiting from exports to the grid at an earlier stage; although there may be some trade-off regarding their level of access to the grid as constraints are more common before reinforcements are in place.

   There are also other time restrictions in place due to the state of the networks. In some countries, there is a lengthy waiting list for generators wishing to connect to the system.

3. The **compensation** rules in place - In some countries compensation is in place for generators who are not connected to the system within the agreed time fixed between them and the TSO. Where compensation rules are in place, the amount and the conditions of compensation received differ.

4.3 Wholesale electricity market arrangements

Balancing regime

In order to operate the national networks as efficiently as possible, many Member States have incentives in place for generators to export the amount of electricity previously forecasted and contracted with the TSO. Where the actual amount is not in line with their commitment, generators have to pay charges as part of the balancing regime (although the actual process is not quite this simple). This balancing charge is of particular importance for wind generation as it is difficult to match generation commitment to actual generation due to the unpredictable nature of wind resources.

Different Member States have different approaches for the payment of balancing charges by RES generators. For example, in Denmark (and in Ireland), RES generators are not subject to the balancing regime and the costs for the system due to imbalances are socialised amongst all non-RES generations. However, this is not the case in other Nordpool countries.

Gate closure times

The gate closure time is the deadline for generators to indicate their export position (i.e. the amount that they expect to generate) before real-time delivery. The difference between this indicated position and the actual delivery is the balancing charge to be paid by imbalanced generators.

Unless the costs of imbalance are socialised (as is the case in Denmark and Ireland), the time of gate closure is of particular importance to wind generation. Due to its intermittent and unpredictable nature, wind output is difficult to forecast at the day-ahead and later stages.

The uncertainty in forecasting wind generation decreases significantly as real-time approaches. Therefore, the nearer the gate closure time to real-time delivery, the better wind generators will be able to predict their output. This reduces the risk of wind generators being penalised for system imbalances.

4.4 Ancillary services

Many countries have regulatory frameworks in place that encourage (or oblige) generators to provide ancillary balancing services such as reactive power. This may be on a commercial or regulated basis in which the generator is mandated to provide these services through the grid code. Countries differ in the extent to which they require or allow these balancing services from RES generators.

Where RES generators have the opportunity and are able to provide ancillary services on a commercial basis this provides them with further revenue. If these services are required under the grid code, all generator signatory to the code are legally bound to meet all relevant network requirements.

4.5 Social acceptance, planning and permitting

The EU citizens have widely ranging perceptions of renewable technologies and electricity infrastructure. This leads sometimes to dramatic differences between the planning and permission requirements in each Member State. The difficulties associated with planning and permitting of a project can increase the risks of investors and delay processes, strongly influencing investment decisions.

4.6 Subsidies for other technologies

Many Member States provide direct or indirect subsidies for other forms of generation besides RES. For example, coal is subsidised in Germany and Spain. The UK is currently consulting on the introduction of a carbon price floor which would, in effect, provide assistance for low carbon forms of generation (including RES but also nuclear) ahead of other forms. Where subsidies for other forms of generation are in place, these may encourage investment and generation of these forms of technology at the expense of RES.

5 Potential impacts of non-harmonisation

The non-harmonisation of RES support schemes can have a number of impacts on the energy industry. We consider that these impacts fall into two main categories:

- the impacts that non-harmonisation can have on investment decisions for project development; and
- the effect that non-harmonisation can have on the functioning of national and European wholesale electricity markets.

5.1 Investment decisions

The potential for differences between support schemes could affect the decisions of investors regarding the development of new renewable technology projects. These potential impacts are broadly as follows:

- Decisions of investors regarding where to locate new RES projects;
- Decisions of investors regarding which country to connect to when there are multiple options available;
- The concentration of RES in particular areas of Europe; and
- The potential for additional complexity of EU support schemes.

In this section, we also consider a special case that is likely to emerge in Europe where a RES generator connects into more than one market. Some of the factors that an investor involved in such a project would be expected to consider are set out.

5.1.1 Location of RES development

RES technologies such as solar and wind generation rely on natural resources which vary according to location within the EU. Solar radiation is, to a large degree, dependent on latitude - with southern regions receiving a higher amount of radiation in a given amount of time. Wind resource is distributed in a less predictable manner depending on a number of factors although, in general, resource is greatest in the North (e.g. Norway and Sweden) and in the West (e.g. the UK, Spain and France) of Europe.

Save for exceptional circumstances (e.g. where wind speeds are too high for a wind turbine to operate safely), higher amounts of resource generally allow the same renewable technology to produce more energy in a given time period.

The most cost-efficient way for the EU as a whole to achieve its RES targets would be to locate generation where it will provide the most low carbon electricity to the network at least cost (including network reinforcement and any other costs). Although it is slightly simplified to assume that the most cost-efficient areas will always be those with the greatest resource (as many factors have an effect on cost), we would expect the efficient development of RES to be reasonably and strongly correlated to natural resource levels.

Figure 5 shows the actual location of solar PV generation capacity installed up to 2009 (shown in the bubbles) mapped onto the solar irradiation incidence (a measure of solar resource) across the EU. Figure 6 shows the same but for installed wind generation and wind power potential.

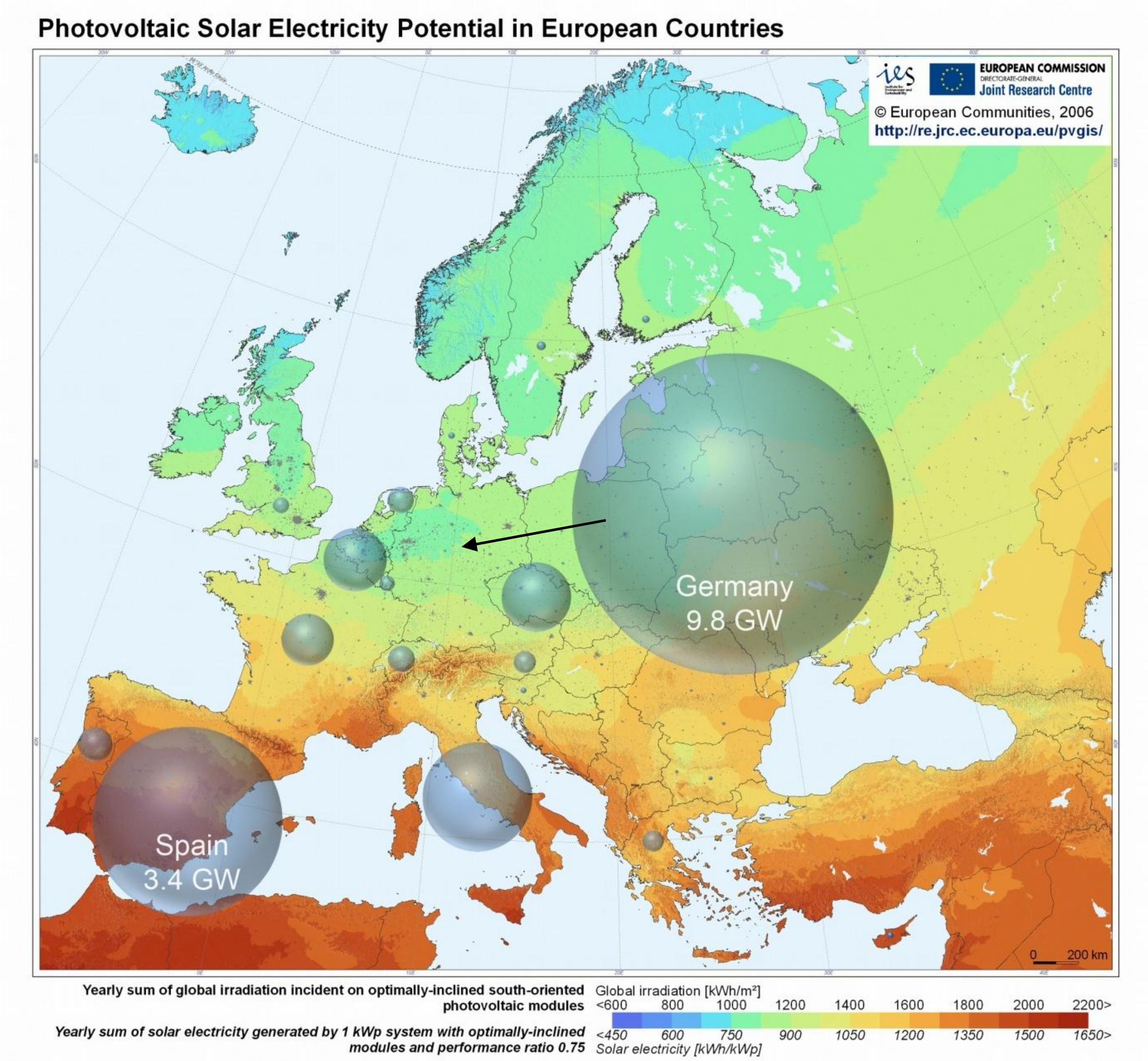

Figure 5: Solar PV installed capacity map, 2009, Eurostat data. Source: Map provided by EC, 2006

The Figure shows that Germany, Spain and Italy have the largest installed capacity of solar PV generation. In the cases of Spain and Italy, this large amount of capacity is matched by large levels of irradiation. However, Germany (in addition to other examples to a lesser degree, such as Belgium and the Czech Republic) has the greatest level of installed capacity in Europe by some distance yet benefits from relatively low solar irradiation. Rough estimates taken by looking at the Figure suggest that even in the very far south of Germany the amount of electricity generated by a 1 kW peak (kWp) system would be about 1050 kWh per year compared to more than 1500 kWh generated by the same system in areas of Spain and Italy.

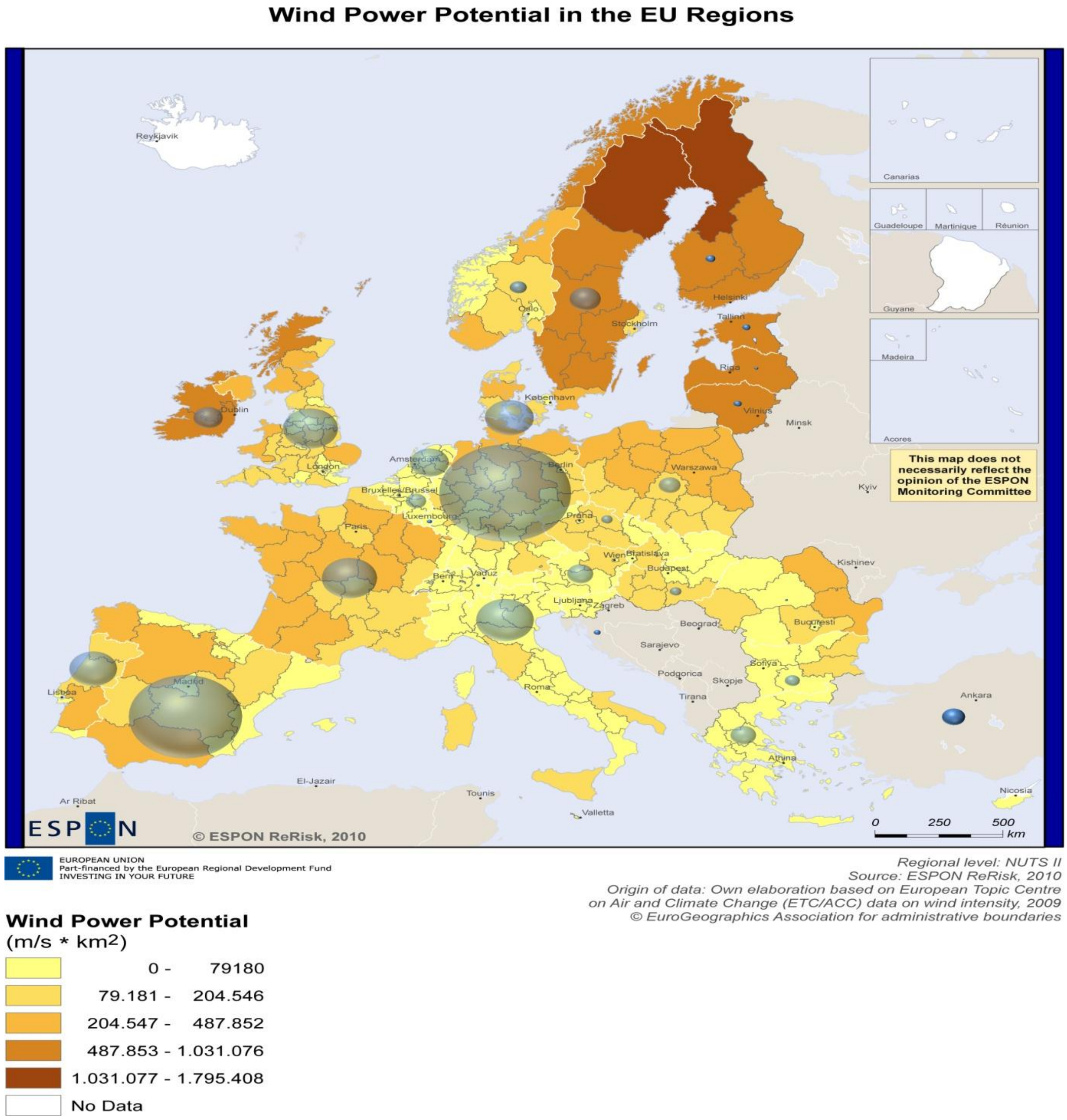

Figure 6: Wind installed capacity map, 2009. Source:Eurostat data

Figure 6 is more difficult to summarise due to the more variable dispersion of wind resource. However, it can be observed that the Scandinavian countries in particular provide examples of countries with high levels of resource but low levels of installed wind capacity. In contrast, Germany (as well as Denmark, Italy, etc. to a lesser degree) does not have particularly high wind power potential but, along with Spain, has the greatest installed wind capacity in Europe.

These two Figures provide evidence that RES capacity has, to date, not been developed based on greatest levels of resource. It is more difficult to draw conclusions as to why this is the case and it is likely due to the combination of a number of factors as set out below.

The impact of support schemes on location

It is possible that the differences between RES support schemes that were highlighted in Section 3 of this document may provide incentives for investment in certain Member States that may not always be in line with the level of resource available at least cost.

As explained in section 4, the most obvious incentive for investors to locate generation in a certain Member State is the **level** of support that they expect to receive. As discussed previously, this level varies significantly between Member States and a high level of subsidy may encourage RES to be developed in an area with relatively low resource while a low subsidy may deter investment in high resource areas.

Differences between **type** of support may also affect the decision of where to locate. The different levels of inherent certainty and risk associated with the schemes may influence the decisions of project developers regarding location. As discussed previously, FITs are generally considered to be lower risk than the more market-based schemes. Thus, smaller market players or those developing relatively immature technologies may prefer to locate in areas where they will receive the more certain FITs, whereas larger players and those developing relatively competitive generation technologies may prefer the higher risk / higher return TGC schemes.

Investors may also be influenced by the **structure** of the support scheme in place and by the perceived level of support scheme **stability**. Investor confidence can have an important role in the development of RES at a national level. Where a support scheme has been in place for a long time with relatively little change and is structured to provide long-term certainty of support, this can encourage the growth of a market and provide investors with confidence to commit to projects. For example, Germany has had a transparent FIT in law since 1990, and the overall regulatory framework has remained relatively stable over this period. Regulatory stability, as well as high levels of support, is likely to be one of the factors explaining the large amounts of installed capacity and the success in establishing a strong PV manufacturing sector.

Where there is less certainty, this can detract from investor confidence and discourage investment and market growth. Moreover, regulatory changes in one area can have knock-on effects in others, for example a decision to cut back on FIT levels for solar PV could affect confidence that support for other types of generation will continue to be provided at the same level. However, the extent to which this may be the case is not explored in this paper.

Other factors affecting RES location

In addition to differences between support schemes, many of the other areas of non-harmonisation as set out in section 4 of this document will affect the decisions of investors regarding where to locate generation.

We previously analysed that efficient siting of RES generation was not quite as simple as development in the areas of greatest resource but that the upfront costs of project development and connection also needed to be considered. In addition to the amount of resource which will influence the amount of output, the cost of installing and connecting the generating plant to the grid would be affected by the local environment and conditions. Deep sea offshore generation and generation in remote areas with difficult terrain is likely to be expensive.

Figure 6 shows an area of high wind resource in the north of Sweden. We would expect a wind generator located here to produce a large amount of electricity given the high wind speeds. However, it is possible that the area may be situated in difficult terrain a long way from the national network. Therefore, the high resource does not necessarily mean that RES will be more economically located in this area. While generation output may be high, this may be outweighed by the up-front costs of building and connecting (and reinforcing) the installations.

Investor decisions about where to locate generation and which national network to connect into will also be affected by the connection and charging rules associated with that network. The **level** of charge, **time** required to gain connection to the system and the **compensation** rules in place should the connection be delayed will all influence an investor's decision of where to locate.

Another factor that is likely to be considered is the exposure of RES to imbalance charges. This is especially important for RES that is unpredictable in nature (such as wind). The fact that Denmark does not expose RES to imbalance charges may make it a more attractive place for unpredictable forms of RES to invest compared to other Nordpool countries and indeed much of Europe. This may lead to developers locating generation in Denmark ahead of other countries which may have greater levels of cost-efficient resource.

Where RES generators are charged for system imbalances, the time of gate closure may affect the decisions of wind project developers about where to locate. A country which has gate closure closer to real-time will be more attractive as RES will be able to forecast its position with more accuracy.

The other factors discussed may also have an effect on investor decisions. Different treatment of ancillary services, the level of permitting and planning risk identified and subsidies for other forms of generation may all influence the perceived attractiveness of a market to an investor.

While any one of these factors taken in isolation may not be considered to have as great an effect on investor decisions as the support scheme which a country has in place, the combination of factors may lead investors to weigh the attractiveness of the support scheme against the other factors that will impact on expected profitability and project risk.

5.1.2 Connection decisions

The incentives for developers to seek the highest subsidy may affect their connection decisions in addition to their locational development decisions. This issue is best explained using the example of offshore wind generation (the issue may also exist, but to a lesser extent, with onshore generation near to a border which has the option of connecting into multiple countries). As technology and cost efficiencies allow offshore wind generation to be located further out to sea, the situation may start to arise where a generator has the option of connecting into the network of a number of different Member States.

The unit cost of electricity for a country to meet its electricity demand is indicated by the market price paid to generators for the electricity that they deliver to the network. In the absence of support schemes, a generator with a choice between connecting into two countries would make its decision through balancing the costs of connecting into the network (affected by variables such as length of connection and environmental conditions) and the forecast average wholesale market price (which provides an indicator of the average price paid to electricity generators for their electricity). It may be argued that this would be an efficient outcome as the demand for new generation to connect to either country (indicated to some degree by the wholesale price) is compared against the additional cost of the connection. It should be noted that as the internal energy market develops, national wholesale prices are expected to converge. This will increase the importance of the cost of connection for the decision of the investor.

However, the estimated profitability of a support scheme may also impact upon the decision of a generator to connect into either country. The additional benefit provided by the support scheme may skew the previous balance of incentives between the wholesale market price and the cost of connection.

A generator may have an overall incentive (provided by the sum of the wholesale price and the support scheme subsidy, in the case of feed-in premiums) to connect into one country even where the wholesale market signals (which provide an indication of the demand for new generation) indicate a greater demand to connect into another. This may also be the case for the cost of the connection to the onshore network. Even where the connection to one country may be significantly more expensive (due to distance for example), these increased costs may be outweighed by the additional support that the generator will receive. The importance of this balance between cost of connection and the level of support scheme provided is likely to increase as the wholesale market prices from one country to the next begin to converge.

Other factors
The other areas of non-harmonisation that have been discussed previously will have a similar effect to the provision of support schemes in influencing the decisions of investors because of the additional costs and risks placed on the generator. Factors such as the connection and charging regime, the treatment of imbalances and ancillary services may all be factored into the decision of an investor who is in a position where it can decide which country to connect into.

For example, the importance of the time taken to receive a connection to the national network on a developer’s connection decision is highlighted by an existing case in the Irish Sea. The planned Codling Bank wind farm located near the Irish shore is expected to request a connection into Great Britain rather than Ireland (although it may connect into the Irish network at a later date) due to the shorter waiting time for a connection.

5.1.3 RES concentration

As described above, the differences between renewable support schemes (as well as non-harmonisation of other factors) may create incentives for developers to locate their generation in certain areas and connect into certain countries in order to receive the most profitable support. This could lead to the connection of RES being concentrated in a handful of countries where the support provided is greatest, which may make it difficult for those countries that provide less support to meet their RES targets.

This may be seen to encourage market-based competition for Member States to support RES. Those that wish to develop a large amount of RES, perhaps even in excess of their targets are able to provide the levels of support to encourage this growth. However, where countries have decided to be less ambitious they may be happy to provide less support at less expense.

However, the concentration of RES to a small number of countries requires large amounts of infrastructure development to incorporate the additional renewable electricity flowing into the network. It is possible that the large amounts of additional flow into certain parts of the system may have knock-on effects to neighbouring countries that may also need to reinforce their network in order to accommodate the additional cross-border flows. It is possible that this is already the case in the Netherlands where it has been suggested that infrastructure is being reinforced to accommodate large amounts of wind generation development near to the border in Germany.

Although analysis has not been performed to identify whether the more or less concentrated approach would be more economic at a European scale, it is possible that greater concentration would benefit from economies of scale and so be the more economic option at this level. However, this approach would also require a high concentration of capital investment into a small number of projects and thus countries, making the investment requirements a potentially more significant challenge to development. In contrast, a more dispersed concentration of RES would share the investment requirements more evenly across Member States.

5.1.4 Increased complexity

Another potential effect of the wide range of differences between support schemes is the inherent increased complexity compared to a single harmonised system. Investors who are used to the type, level and structure of a support scheme in one country may find it difficult to adjust to a different scheme in another. This may act as a barrier to entry, particularly for smaller players who may not have the experience and resources needed to invest in a range of countries. Therefore, this additional complexity may discourage the growth of RES at European level thus increasing the difficulty of meeting the European RES targets.

It is possible, in theory at least, that the additional complexity of a range of schemes may increase the potential for gaming or double counting. This is not likely to be an issue currently where RES is supported by one country which provides the support and into which the generation is connected. However, a number of tools have been introduced by the Commission (discussed later in this paper) that allow Member States to share responsibility for the support of RES without any requirement for direct connection into their own national network.

The potential for additional confusion of having a number of schemes that have different levels and structures of support provided in different ways, may raise the potential for miscalculation of support provisions where these tools are used. This could be, in theory at least, deliberate gaming from developers or accidental 'double counting' of support.

The increased complexity of having different national schemes may also raise the potential for a lack of confidence amongst investors. The potential for regulatory uncertainty to discourage investors at national level and its effect on the location of renewable developments was discussed previously. What is less clear is whether there is potential for knock-on effects of regulatory uncertainty in one Member State to affect neighbouring countries and the rest of Europe. However, it seems possible that investors could be affected by the political scene as a whole, although whether or not this is the case would require further analysis. For example, the decision of one Member State to revise its support scheme may make an investor less certain of the continuity of support schemes in other countries.

Several Member States, such as Spain, Italy, the UK and the Czech Republic, are in the process of cutting back support on established schemes, e.g. for PV, sometimes retro-actively. It is possible that these changes in some of the most consistent Member States in terms of support scheme provisions will have a knock-on effect to investor confidence for support schemes in Europe as a whole.

5.1.5 RES connection into more than one market

As technology and cost reductions allow RES to be located in areas that were previously not possible, the EU may start to see generation being developed in new areas (e.g. offshore wind generation in the north European seas). The location of this generation may make it more efficient to connect directly into an interconnector rather than into a national network or to connect into more than one market (thus forming a makeshift interconnector). This gives the additional benefit of providing more than one market for the RES.

Where a RES generator is planning to connect into more than one market, there are a number of considerations with regard to the support provided. Between the countries involved, it needs to be decided:

- Which price zone will the generation be included in?
- Which country will provide support through their support scheme? If this is to be shared, how would this be achieved?
- Which country receives the allocation towards achievement of their RES targets?

The first of these questions and a number of other issues related to the connection of generation into more than one country are being explored through the North Seas Countries Offshore Grids Initiative (NSCOGI). More information is provided on the options under consideration in Annex 3 of this document.

The cooperation mechanisms provided in the RES Directive have an important role to play in answering the questions regarding who should support the generation and who should receive the RES target allocation. The mechanisms allow support to be provided and RES contributions to be received by a country even where the electricity does not flow into that country's network. This opens up the possibility for the countries involved, and indeed any third party country to agree between themselves who provides support and receives the benefit. More detail regarding the cooperation mechanisms including developments in Europe is set out in section 7 of this document.

5.2 Market effects

In addition to the impact that non-harmonisation of support schemes can have on investment decisions, there are also potential implications for the functioning of national electricity markets and the European market as a whole.

5.2.1 Effects on electricity wholesale market price

One of the potential effects of non-harmonised support schemes is due to the differences between the ways in which the different types of scheme interact with the wholesale electricity market.

TGCs and FIPs are both market-based mechanisms. TGC schemes require suppliers to source an increasing amount of their supply from renewable sources. Where a TGC scheme is in place, RES electricity will therefore be traded directly through the market receiving the wholesale market price in addition to the competitive market price for the certificate itself. FIPs provide a set amount of support to RES in addition to the wholesale market price. Generators are therefore still exposed to the market and influence the market price.

Where RES competes in the market, the low marginal costs of the generation and the set level of support provided in addition to the market price encourages generators to bid into the market at very low prices thus placing downward pressure on the wholesale price.

In the case of FITs, a fixed amount is provided to RES for the amount of electricity produced. FITs are therefore completely separate from the market and have no direct effect on the wholesale price. However, they may affect the wholesale price indirectly, potentially significantly, through incentivising more RES generation being put into the system, so that supply is increased reducing the demand for market-based generation (often conventional generation). In reducing demand for market-based generation the market price will shift downwards in the demand curve.

The European Council (4 February 2011) set out the target for achievement of the EU internal energy market by 2014. This includes an increase in interconnection and harmonisation of market characteristics in order to encourage convergence of national prices (market coupling). The intention is to allow greater competition within a wider EU energy market.

The different interactions between each scheme and the wholesale market may impact upon the desired goal of efficient market coupling. The differences between schemes will impact upon the market price in different ways in each Member State. The wholesale market price will therefore not be fully reflective of the supply and demand conditions within the market but will be “distorted” to varying degrees depending upon the impact of the support scheme. This will not discourage markets from coupling but will distort the times at which they are coupled as the market price will not reflect the underlying supply and demand conditions. It may be argued that this will detract from the price and flow efficiency gains which are expected from the coupling of national markets.

The case of different schemes within a market coupled area can be identified in the Central West Electricity (CWE) region. Wallonia and Flanders in Belgium use TGCs which may affect the market price directly while the FITs used in the Netherlands will only affect the market price through the increase of competition for conventional generation. This may influence market coupling between the Netherlands and Belgium which are both part of the market coupled CWE region. The market prices within the region may converge at times when it would be more efficient to have a price differential and vice versa due to the impact of support schemes.

As set out above, the differences between support schemes may influence wholesale market prices to a different degree in each Member State and so impacting upon the efficiency of market coupling. However, it is important to note that there are many other areas of national electricity markets that differ, sometimes to large degrees, from Member State to Member State. The examples of policy approaches taken towards negative pricing and the balancing regime are provided below. Differences in how Member States treat these will affect market price and thus may have similar effects on market coupling as those set out above. It is difficult to compare the impact that support scheme non-harmonisation and these other factors will have in this regard. We welcome responses from stakeholders on their perceptions of this issue.

Other factors – negative price policies

FIPs and TGC schemes force RES to compete in the market but provide them with additional support on top of the wholesale market price. As generators gain this additional support on top of the wholesale price they can still make an overall profit even where the wholesale price is negative. That is, they may actually pay the market to generate in order to gain the additional support that is provided. This may lead to negative market prices at times of high renewable supply and/or low demand.

FITs (as well as FIPs and TGCs) may raise the possibility of negative prices in a less direct way. By encouraging investment and dispatch of RES ahead of other generation (note that the RES Directive requires that RES should be guaranteed dispatch in any case), FITs encourage investment in and supply from RES at the expense of generation from other sources. In periods of low demand and high RES output, a high supply/demand ratio may force base-load conventional generation[24] to generate even at negative prices in order to avoid the costly effects of switching off and re-starting plants.

Negative prices have occurred in some countries at times of low demand and high renewable output[25]. A European power market closed with a negative power price for the first time in October 2008. Between October 2008 and November 2009, 71 hours of negative prices were observed on the European Energy Exchange (EEX).

Different countries have dealt with the possibility of negative prices in different ways. The power exchanges in some countries, such as Germany, have allowed negative prices on the basis that this is the most economically efficient solution. In 2010, revised rules adopted by the German energy regulator (Bundesnetzagentur) empower the TSOs (responsible for

[24] Note that this includes the required base loads of some more flexible generation types. That is the required amount of generation needed to keep machinery running and avoid expensive and time restrictive re-starting.

[25] See Nicolosi (2011) for a study on negative prices in Germany: http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Working_Paper/EWI_WP_10-01_Wind-Power-Integration.pdf

marketing RES on the exchange) to set price limits (floors) in a range of –150 to –350 euro/MWh in specific circumstances.

In Denmark, it has been decided to tackle the potential issue of negative prices by setting the subsidy provided to renewable generation to zero when the market price becomes negative. This still allows market prices to become negative but reduces the potential for over supply resulting from high RES output as these forms of generation will not be receiving the additional subsidy when prices are negative.

The different types of schemes adopted in Europe and the approach of each country to negative prices could lead to artificial differences in price. Where negative prices may be occurring, it must be decided whether to allow the price to fluctuate freely or to set some form of price limits or floors below which prices cannot fall.

To date, the EU has not experienced market distortions between Member States due to the different administration of negative price floors. However, as the deployment of RES advances negative prices are likely to become more common and market distortions may start to arise, jeopardising the achievement of a single EU energy market with market coupling between Member States. For example, the prices of countries with different policies towards negative prices may not be able to correlate where they fall below a certain level. This could lead to electricity being delivered in the opposite direction to actual demand. In addition, it is not yet clear whether market coupling algorithms can currently, or will be able to, cope with negative prices. In the case of volume coupling, negative prices could lead to a situation where no electricity is being traded across an interconnector despite a difference in market prices.

Other factors – Balancing regime

Some of the other areas of market non-harmonisation previously discussed may also have an effect on the functioning of the market. For example, the treatment of RES with regard to the balancing regime may affect market coupling in a similar way to support schemes.

Where a country (such as Denmark) has allowed RES to be exempt from the balancing regime, this may impose a more onerous balancing task on the balancing responsible party as it needs to meet the balancing requirements of RES without being able to charge the responsible generator (who therefore does not need to attempt to balance its position). The balancing party will therefore have to balance the system at greater expense, which will be passed on to the rest of the industry paying balancing charges. Therefore, a greater balancing price risk may be imposed on generators in some countries compared to others. This will in turn impact upon the wholesale market price both by encouraging RES onto the system (downwards effect on market price) and by increasing costs for conventional generation (upwards effect on market price).

In addition, differences in the approach taken towards the balancing regime may have cross-border balancing effects. Where RES is exempt from balancing in one country the balancing responsible party may be forced to export the resulting imbalances across to neighbouring countries (i.e. the contracted import or export across the interconnector is not met). Because of the contractual agreements in place to import or export a certain amount of electricity across the interconnector, compensation is likely to be in place for the party who finds itself out of balance because of the actions taken by the responsible balancing party. However, it is still likely that the possibility for transfer of imbalances will detract from pan-European market efficiency.

These issues may be mitigated where the balancing responsible party or others are incentivised to forecast or where gate closure is closer to real-time thus allowing generators to give a better indication of their position. This will reduce the balancing risk placed upon the balancing party and reduce their balancing costs thus reducing the effect on the wholesale market price.

6 Potential benefits of non-harmonisation

In Section 5 of this document, the potential negative impacts of non-harmonisation of support schemes on investment decisions and market functioning in the EU were set out. However, even considering these potential implications, harmonisation might be ineffective or even damaging for RES development at this stage. This consultation document does not provide a position on whether harmonisation would be beneficial but discusses some of the key points to be considered when deciding on harmonisation of RES support schemes.

Different schemes for different ambitions

The RES Directive defines legally binding RES targets for each Member State to meet by 2020. These national targets depend significantly upon the existing state of RES deployment at that time and GDP on the Member State. Furthermore, some Member States have farther reaching RES ambitions beyond the defined targets or want to encourage certain types of RES in particular ways.

To date, the Commission has not been prescriptive with the design and implementation of support schemes in each Member State but has instead provided Member States with a level of freedom in determining the design of their support schemes in order to reflect the different ambitions and positions of each country.

For example, one country may favour FITs in order to encourage one type of RES technology that is still in the early stages of development. Another may favour a more market-based scheme such as TGCs and may wish for this to be technology-neutral thus only encouraging those technologies which are closest to competing with conventional generation.

Many countries have developed schemes that differentiate by technology to strike a balance between static and dynamic efficiency. A harmonised support scheme not differentiating between technologies would encourage only the most competitive type of generation. Even a scheme differentiated by technology would most likely be universally applied across the EU and so would encourage the same types of technologies to the same degree rather than allowing Member States to cater for the development of the technologies on which they wish to focus.

The ability of Member States to differentiate their schemes provides important benefits. Previous studies have concluded that the different schemes in place in each Member State may in fact complement each other in this regard.

Investor confidence

We previously stated the importance of regulatory certainty to provide investors with confidence and encourage RES development. The non-harmonisation of support schemes may increase the risk of regulatory uncertainty as already discussed in this document, and could have a knock-on impact to investor confidence in other Member States. However, the harmonisation of support schemes would require some potentially fundamental changes to the type, level and structure of support provided by some countries. This dramatic change to the provision of support could have a negative effect (at least in the short term) on investor confidence and detract from the benefits of support schemes that have been built up over a number of years.

Existence of other factors

Much of the academic literature has detected significant cost savings in meeting the RES targets under a harmonised support scheme as opposed to national support schemes. However, as a number of other studies[26] have suggested, the level of these modelled efficiency savings are highly sensitive to the inputs used.

As outlined in section 4 of this document, there are many other potential areas of non-harmonisation between countries in addition to support schemes that may affect incentives for investors regarding location and connection of new RES developments. Some of these factors, such as variation between system charging policy, may also have a cross-border market impact as they may affect the prices that generators pay to use the system.

The levels of efficiency savings, as possible effects of support scheme harmonisation – suggested by some of the studies[27] – have often been based upon assumptions of a fully developed internal energy market with consistent market principles across the EU. This is currently not the case. More recently, the focus of research shifted towards considering the materiality of these other areas of non-harmonisation, suggesting that harmonisation of support schemes may not be as effective as possible before harmonisation in other areas provides a more favourable environment for efficiency savings.

[26] See the studies: Del Río, Pablo (2005): “A European-wide harmonised tradable green certificate scheme for renewable electricity: is it really so beneficial?” In Energy Policy 33 (2005) pp. 1239-1250; “Review report on support schemes for renewable electricity and heating in Europe”, January 2011, within the project RE-Shaping, http://www.reshaping-res-policy.eu/

[27] See footnote 16 and 26.

7 Existing tools to allow efficient achievement of the RES targets

The Commission has previously focussed on encouraging co-ordination of support schemes based on the 'two pillars' of cooperation and optimisation. Evidence showed that this approach – based on the implementation of best practice – is encouraging gradual convergence of key properties of support schemes.

However, in the near to medium term, before the necessary conditions for harmonisation are developed, the non-harmonisation of support schemes will continue to have an impact on the investment decisions of developers. In order to overcome these impacts, and to encourage cost-efficient achievement of the RES targets at EU level, the Commission has developed the following cooperation mechanisms:

- *Statistical transfer (Art. 6)* – Member States may agree to statistically transfer a specified amount of electricity produced from renewable sources from one Member State to another. This amount will be deducted from the RES contributions of one Member State and added to the other's.
- *Joint projects (Art. 7)* – Two or more Member States may jointly finance an RES project thus sharing the costs and benefits (including the RES contributions) of the project. There are also provisions for entering into joint projects with third countries.
- *Joint support schemes (Art. 11)* – Two or more Member States may decide to join or partly coordinate their national support schemes. This will allow a certain amount of electricity from renewable sources produced in one Member State to count towards the national targets of another, either through a statistical transfer or through an agreed distribution rule allocating contributions accordingly.

These tools are set out in the Renewables Directive and provide for cross-border cooperation in order to facilitate a joint and efficient approach towards achieving the EU RES targets.

Statistical transfer and joint projects could be of particular importance for facilitating efficient exploitation of resources by allowing projects to be developed and connected outside of Member State boundaries. Joint support schemes can have the same effect and may also encourage convergence towards a pan-European harmonised support scheme.

Statistical transfer allows Member States that surpass or are expecting to surpass their RES targets to sell some of the excess renewable generation to another Member State that may not be expecting to meet their targets from domestic developments alone. A country with high output / low cost RES potential will be able to fully exploit its resources in the knowledge that it is able to sell any excess to another country. In addition, those countries which consider that more cost-effective RES options exist in other Member States should be able to exploit these resources through agreement of a statistical transfer. This should allow RES to be developed where it is most cost-efficient.

Joint projects may perform a similar function. They allow joint investment from more than one Member State in a RES project in one country with both Member States sharing the contribution towards RES targets on an agreed basis. It is not required that the electricity generated by the RES project feed into the national network of all countries involved. By allowing Member States to share the costs and benefits of RES developments, joint projects encourage investment in the most cost-efficient areas of Europe in a similar way to statistical transfers. As an example, a number of countries with an interest in RES development in the

North Seas are investigating the use of joint projects in order to facilitate cost-effective development (summarised in section 7.1 of this document).

In addition, the RES Directive contains provisions for joint projects with third countries (although in this case the generation does need to connect into the EU). This will allow Member States to make agreements with third countries to exploit the most cost-effective resources in order to meet their RES targets. Italy is an example already investigating the potential for joint projects with third countries as an important part of its strategy for meeting its RES targets (described in section 7.1 of this document).

Joint support schemes provide a framework for moving towards a more harmonised European support mechanism through incremental convergence of support schemes in different regions of the EU. The introduction of joint support schemes is also expected to bring incentives for investment decisions. The RES Directive stipulates that Member States who have a joint support scheme can distribute a certain amount of RES electricity generated in their territory, either through a statistical transfer or a distribution rule agreed by the participating Member States. This will allow generation to be built in the areas in which it is most cost-effective with all of those involved in the joint scheme potentially benefitting (depending on the benefit sharing agreement). The development of a larger market may also produce a more stable, liquid and better functioning market providing greater investor confidence. It may also introduce healthy competition between countries for the development of RES, as expected under the planned joint support scheme between Norway and Sweden (summarised in section 7.1 and described in the more detailed case study in Annex 3 to this document).

7.1 Use of the cooperation mechanisms

The cooperation mechanisms were introduced through the RES Directive in 2009 but none of them have been implemented yet. However, many Member States are considering and planning to use these mechanisms in order to facilitate cross-border cooperation.

Norway-Sweden joint support scheme

The planned joint support scheme between Norway and Sweden is the most notable of the current initiatives and is the only example of a planned scheme at a late stage of development. Norway and Sweden plan to introduce the joint scheme on 1 January 2012.

The proposed scheme is a market-based TGC scheme without differentiation between technology types. One certificate is provided per MWh of output from a certified RES. These certificates can be traded by the generator in addition to the produced electricity. Demand for certificates is introduced by a quota on suppliers and electricity intensive users to source a certain amount of their electricity from RES. The scheme is designed in a way that it favours technology that is already cost competitive.

Norway and Sweden will use a 50-50 distribution rule to allocate the amount of RES in the two countries when reporting to the Commission on the progress of reaching the national overall renewable targets. This rule is, amongst other issues, regulated in a common treaty between Norway and Sweden.

Other relevant areas which need to be harmonised include basic functionalities and rules, such as the time period of the support, the legal status of the electricity certificates and the key principles of what constitutes legitimate certified renewable generation. It is believed that some other factors can be left for the market to develop.

The scheme has been designed to stimulate the development of 26.4 TWh of renewable generation in the period between 2012 to 2020, shared equally between the two countries. It is anticipated that more than half of this capacity is to come from onshore wind developments which the countries expect to be shared equally. The remainder is expected to be developed through additional hydro power in Norway and biomass power in Sweden. As the scheme is fully market-based, the two countries will compete for the development of new generation. This should help to encourage the development of RES in the areas where it is most cost-competitive.

More details on this case study are provided in Annex 3 to this report.

Italy's plans for joint projects

In the 'Re-shaping project' report[28], a case study focuses on the envisaged use of joint projects for Italy. This report highlights the high amount of interconnection already in place in Italy and the investment projects already undertaken by several Italian companies to exploit resources in third countries and import this electricity through new infrastructure.

Along with the other Member States, Italy submitted a forecast document setting out estimated demand for RES that is not expected to be met from domestic production by 2020. In this forecast document, Italy declared a deficit of around 13.6 TWh and that it planned to meet the deficit through the use of joint projects with third countries under Article 9 of the RES Directive. This may include import of RES from Switzerland, Albania, Tunisia and Montenegro[29].

One of the main issues for Italy is the definition of the support scheme. The RES Directive does not allow the third country involved in the joint project to grant any form of support to the project other than investment aid. Therefore, Italy would have to incorporate all of the generation into its support scheme.

Italian law has already been developed to allow TGCs from third countries to be allocated where they have a similar scheme in place on the basis of a ministerial agreement. Such an agreement has already been signed with Albania in 2006 which led to a partnership between the Italian and Albanian energy regulators with the aim of harmonising the regulatory framework. Under this agreement, TGCs can be allocated to the actual production and to the quota of electricity which is the object of an export contract and has received a guarantee of origin (GO).

Negotiations on similar agreements are under way with Serbia and with North African countries.

Signs of development in the North Seas

[28] "Review Report on Support Schemes for Renewable Electricity and Heating in Europe", Re-Shaping, January 2011, http://www.reshaping-res-policy.eu/downloads/D8%20Review%20Report_final%20(RE-Shaping).pdf
[29] Source: Italian National Renewable Energy Action Plan, **Error! Hyperlink reference not valid.**, page 159.

As technological and cost developments allow renewable generation such as offshore wind to be built further out to sea, the potential arises for a situation where RES which lies in the seas of one country may connect into the network of another country more cost-effectively. This may be further complicated by an additional connection into another country at a later stage.

An example is the Codling Bank project in Irish territorial waters which may seek a connection into the GB network before possibly connecting into the Irish network at a later date. This project therefore requires the use of one of the cooperation mechanisms such as statistical transfer or joint projects to allow cost and benefit sharing of generation that will be developed in the waters of one country while connected into another's network.

There are signs that other countries with an interest in RES in the North Seas area are also beginning to investigate the use of joint projects in order to allow the necessary cost and benefit sharing. The UK is exploring the use of joint projects alongside Ireland and the Channel Islands through the All Island Approach[30]. More detail on these projects is provided in the case study in Annex 3 of this document.

[30] All Island Approach to open up renewables opportunities, http://www.decc.gov.uk/en/content/cms/news/pn11_050/pn11_050.aspx

8 Preliminary conclusions

The debate surrounding EU support schemes and whether they should be harmonised has been present in EU political and academic circles for a number of years. Much of this debate has focussed on a comparison of the different types of mechanisms and on the efficiency savings that could be made by maximising the deployment of RES in optimal resource areas. More recently academic literature and this report have suggested that this approach is overly simplistic and that considerations of other aspects of support schemes as well as additional factors related to market design need to be explored further.

This report suggests that the fact that the 2009 Renewable Energy Directive set binding targets on a Member State level, as opposed to a regional/EU level, has led the majority of Member States to maintain or introduce national support schemes which differ on a number of substantial details. It also suggests that these differences can indeed have an impact on the decisions of investors regarding where to locate generation. This consultation seeks stakeholders' views on the significance of these impacts in comparison to the effects of non-harmonisation of some of the other factors set out in the report.

In addition, the report explores some of the implications that support scheme non-harmonisation may have on the functioning of national and European wholesale electricity markets. Our background research into this report has suggested that this area has not been considered in as much detail as the impacts on investment decisions. As national markets become more interconnected it may be important to consider the market effects more thoroughly. Non-harmonisation of support schemes and of other market characteristics may distort price formation and the efficiency of market coupling. This may detract from the objective of an internal energy market set out in the 3rd Energy Package.

The potential for differences between support schemes to affect investment decisions and encourage generation to locate away from the areas of greatest cost-efficient generation have been known to the Commission since long before the adoption of the RES Directive. However, the Commission has so far taken a conscious decision giving Member States the flexibility to structure their support schemes individually rather than imposing a European harmonised support scheme on all Member States.

One factor supporting this decision is the existence of other areas of non-harmonisation between countries that may impact upon investment decisions. A number of studies have supported the view that in the absence of a more harmonised overall energy market, the harmonisation of support schemes may only bring limited benefits which may be outweighed by the costs of such an approach. A move towards the EU internal energy market and the Framework Guidelines and Network Codes will lessen these other differences and provide a more beneficial environment to allow for maximum efficiency gain through harmonising support schemes.

Instead, the Commission has developed three cooperation mechanisms explored in this report in order to encourage Member States to develop RES where it is most efficient. Despite the fact that no EU programme is as yet making use of these schemes, evidence is emerging in many areas of Europe that the use of the mechanisms is under consideration and planning in Member States with neighbouring countries and those with whom projects are already underway. This is likely to encourage a regional approach towards efficient RES investment locating rather than pan-European efficient concentration of RES into optimal resource areas.

However, the use of these mechanisms is a positive step towards pan-European cost efficient investments. Further, a regional approach may develop into a more pan-European approach as more countries investigate the use of these mechanisms and regions begin to cooperate. In addition, a regional approach may strike a balance between the most efficient siting of RES and the large amounts of network infrastructure required if RES investment becomes too concentrated in one area of Europe.

Further, there are existing barriers to the use of the mechanisms. For example, the allocation of costs and benefits between the Member States involved can be difficult to agree upon. The level of support provided by each Member State needs to be balanced against the separate benefits of RES target contributions (e.g. increase in system capacity, social acceptance and local economic effects). The first projects considering and planning the use of cooperation mechanisms will help to solve these issues. The North Seas Countries' Offshore Grid Initiative (NSCOGI) project is considering cost/benefit allocation as a whole, including an analysis of the allocation of costs and benefits through the cooperation mechanisms. Additional work in this area at national and EU level is necessary and is welcomed.

Annex 1 – CEER

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

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

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

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

This report was prepared by the Sustainable Development Task Force of CEER's Electricity Working Group.

Annex 2 – List of abbreviations

Term	Definition
CEER	Council of European Energy Regulators
CWE (region)	Central West Electricity (region)
DECC	Department of Energy and Climate Change
EC	European Commission
EEX	European Energy Exchange
FIP	Feed-in-Premium
FIT	Feed-in-Tariff
GB	Great Britain
GOs	Guarantees of Origin
Green Package	The Climate Action and Renewable Energy Package (2008)
MWh	Megawatt hour
NSCOGI	North Seas Countries Offshore Grid Initiative
RES	Energy from Renewable Sources (Also used in this report to mean renewable generation)
RES Directive	The Renewable Energy Directive (2009/28/EC)
ROCs	Renewable Obligation Certificates
TGC	Tradable Green Certificate
TSO	Transmission System Operator
TWh	Terawatt hour