



EUROPEAN COORDINATOR'S THIRD ANNUAL REPORT

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PROJECTS OF EUROPEAN INTEREST

"Connection to offshore wind power in Northern Europe
(North Sea – Baltic Sea)"

&

"Salzach neu (AT) – Tauern (AT) line"

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The points of view expressed in this report are those of the European Coordinator and do not represent the official position of the European Commission.

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Preface

The European policy framework for a future European offshore network and its linkage to the onshore networks, along with the new Article 194 of the Lisbon Treaty, have led to a clarification of the European Commission's powers. The cross-border issues, also regarding the external economic zones in the North and Baltic Seas, require greater willingness on the part of all political, economic and civil-society actors in the participant EU Member States to seek integrated European solutions. With the Memorandum of Understanding of 3 December 2010 the competent ministers in the "North Seas Offshore Grid Initiative" have taken that step with the aim of describing, by the end of 2012, the regulatory, economic and planning-law challenges involved in linking the offshore wind capacities to the European extra high voltage network.

I would like to thank Patrick Bourrel from the Energy Directorate-General for providing competent and critical backup for my work as EU Coordinator, as well as the members of the informal Adamowitsch Working Group and my interlocutors from politics, business and associations for their constructive discussions.

In particular, Professors Lecheler (Freie Universität Berlin) and Belmans (Universiteit Leuven) and Messrs. Neuhoff and Boyd (Climate Policy Initiative), with their expert suggestions, provided important impulses for this report. With their joint paper on partial undergrounding, the European Network of Transmission System Operators for Electricity (ENTSO-E) (Mr Verseille) and Europacable (Mr Neesen) have supplied information in order to create a more balanced debate. Dr Jovicic from the University of Aberdeen submitted a paper to the Working Group on technical considerations for a DC network concept. I would like to thank all of them for their valuable contributions.

Georg Wilhelm Adamowitsch

INTRODUCTION

Decision No 1364/2006/EC¹ of the European Parliament and of the Council of 6 September 2006, laying down guidelines for trans-European energy networks (TEN-E), envisages the appointment of European coordinators in order to monitor and facilitate the implementation of the most critical identified priority projects.

In this context, on 12 September 2007, Mr Adamowitsch was appointed by the Commission as Coordinator for the "**Connection of offshore wind power in Northern Europe (North Sea – Baltic Sea)**". The First and Second Annual Reports on his work can be found on the Europa website², as can the Final Report on the TEN-E project **380-kV-Salzburgleitung**.

The European Coordinator's role is to contribute to the cross-border dialogue between the stakeholders (Governments, Regulators, Transmission System Operators, Industry ...) and promote the European dimension of the grid development.

The signing of the Memorandum of Understanding in December 2010 by the North Seas Countries' Offshore Grid Initiative (NSCOGI) represented major European-level progress towards addressing the issues surrounding the need for a European transmission network linking the future offshore parks in the North and Baltic Seas. Three Working Groups are to submit joint assessments by the end of 2011/2012 on the following themes:

- Network configuration and market integration
- Market and regulatory aspects
- Planning and authorisation procedures

It is important that the competent national regulators and network operators are involved in this political and professional stocktaking. In this way, by the end of 2012 at the latest, a political, regulatory, economic and planning-law framework for the development of a European offshore transmission network can be drawn up. The MoU expressly states that this evaluation is also to include the findings of the "Adamowitsch Working Group".

In this Report the EU Coordinator will present his findings and provide information on the NSCOGI Working Groups in which these findings, which are partly expert opinions, are to be debated.

The informal Adamowitsch Working Group regularly held consultations on the various issues surrounding offshore connection, thus giving experts, NGOs and companies the opportunity to present problems and possible solutions. These discussions also formed the basis of the expert opinions which the EU Coordinator is bringing into the NSCOGI process. The creation and working methods of this informal working group have proved their worth because its informal nature has brought transparency regarding the challenges facing the European offshore network, without leading to conflicts on aims between the various stakeholders which would have required resolution. In this way the EU Coordinator has also complied with the Commission's mandate to involve as many actors as possible in this process.

¹ Decision of 6 September 2006, OJ L262, 22.9.2006, p.1.

² http://ec.europa.eu/energy/infrastructure/tent_e/coordinators_en.htm

Work programme 2010

As stated before in the report, not all 2009 Actions were completed. For this reason certain actions were included in the Work programme 2010.

- Action 1: Promote the development of the offshore grid in the North Sea in modular form

The European Coordinator will take forward the principles behind the combined solution for the Kriegers Flak project as the "best practise case" and apply them to other infrastructure developments such as the Norway/UK interconnector, NordLink or NorGer.

- Action 2: Clarify the role of the regulators for specific offshore and onshore projects

The regulatory aspects of the integration of wind generation in European electricity markets have to be clarified to facilitate the deployment of wind generation and market integration.

- Action 3: Analysis of possible changes to EU legislation aimed at shortening the authorisation process.

In view of sustainability there is a need to adapt environmental law to facilitate the realisation of sustainable energy installations and related transmission lines; this includes considerations for adequate and timely integration of the public concerned.

- Action 4: Financial issues and proposals for boosting infrastructure investments and the industry chain constraints.

1. DEVELOPMENT OF THE OFFSHORE GRID – NORTH AND BALTIC SEA (ACTION 1)

1.1. The “North Seas Countries’ Offshore Grid Initiative” (NSCOGI)

There is no set political or economic opinion within the EU and its Member States on the issue of how a European transmission grid is to be shaped. In 2008, in extensive talks with the Belgian government, the EU Coordinator recommended that the North Sea littoral countries agree on a joint approach so as to create a basis for decisions on the major political and commercial issues. To that end, in December 2009, the countries concerned and Norway signed a joint declaration and asked the Belgian government to coordinate this process, in which ENTSO-E and the European Regulators Group for Electricity and Gas (ERGEG) were involved, representing the transmission system operators (TSOs) and the regulators respectively. This initiative was presented to the public as the European Seatech project. The governments will meet in December 2010 to discuss the way ahead and take corresponding decisions.

The following are to be examined by 2012 at the latest:

- Grid configuration and integration, economic aspects
- Questions of market access and regulatory prerequisites
- Planning and authorisation issues.

For the EU Coordinator this process is vital in order to create the preconditions for a coordinated North Sea grid. The German and Danish sides should input their experiences from the Kriegers Flak project. One focus in this connection should be on the question of

whether binational links between windparks and the relevant national grids or an integrated grid solution³ should be favoured, taking commercial aspects and supply security into consideration. From what he has seen to date, the EU Coordinator feels that a European offshore grid will be the favoured option, as soon as the European preconditions are created, i.e. that NSCOGI continues its work in a structured manner and completes it in 2012.

1.2. "Kriegers Flak": Best Practice?

In his 2009 Report the EU Coordinator described the Kriegers Flak project in detail and expressed his regret that, in spite of the joint declarations issued by the German, Swedish and Danish governments in 2007, the Swedish government had stated in early 2010 that it for the moment no longer wanted to take part in the joint development of Kriegers Flak. He therefore felt it was all the more important that progress on the project continued with the participating companies from Germany and Denmark. From Europe's point of view it is important that a power link be created between the former Nordel area and the UCTE (now ENTSO-E) network.

The project will also provide lessons learned as regards planning and realisation (including regulatory and financial issues) which can be useful for the development of an integrated North Sea network (NSCOGI). This is why the EU Coordinator supported the common application by the two TSOs Energinet.dk (from Denmark) and 50 Hertz Transmission (from Germany) for a grant of € 150 million from the European Energy Programme for Recovery (EEPR) for the planned investment. The two TSOs common planning and investment goes far beyond connection to only one particular national grid by developing a "combined grid solution"⁴, thus creating the technical conditions for a real European power link. This in turn was linked to difficult questions from the German regulator, in whose area the first investments of the common project will be taken. The questions concerned the approval procedure for 50 Hertz Transmissions' investment plan being on national regulatory legislation, which is still not oriented towards this kind of multinational project.

The EU Coordinator talked with the German regulator several times, expressing his commitment to this project and proposing solutions to the problems. He commissioned expert opinions and brought these into the decision-making process. The EU Coordinator also pointed out to 50 Hertz Transmissions' shareholders that the German regulator's room for manoeuvre was limited by legislation. This commitment to the project on the part of the EU Coordinator was instrumental in the success of the two TSO's common application for EEPR funding, which was decisive for the realisation of the common grid solution. Nevertheless some questions concerning the acceptance of investment costs have still to be solved with the German Regulator finally.

The lesson learned from this project is for the NSCOGI to develop criteria enabling a uniform regulatory framework for offshore projects which also takes the international financial market into account.

³ OffshoreGrid study within the Intelligent Energy Europe programme - <http://www.offshoregrid.eu/>

⁴ i.e. interconnector between Denmark and Germany built on national connections of offshore wind farms to the respective national grids. This facilitates energy trade at least during times of low wind. Open for later connection to Sweden.

1.3. NorGer: link between Norway and Germany

The projected first electricity interconnector between Norway and Germany, known as NorGer, is proceeding on schedule as regards technical planning and engineering, as well as the processing of various applications for government permits and approvals. The plans for the 600 km long HVDC interconnector were originally developed by the two Norwegian regional electricity providers Lyse Produksjon AS and Agder Energi AS, together with the Swiss energy company EGL AG, each owning one-third of NorGer.

NorGer will connect the Norwegian electricity system, where hydropower represents almost 100% of production capacity, with the German system dominated by thermal power, although here electricity production from wind energy is expected to increase significantly, particularly offshore in the North Sea. The interconnector will improve security of supply and increase competition in both markets, and at the same time providing cost-effective Norwegian hydropower as a backup to the increasing level of installed wind capacity in Germany.

A NorGer project organisation has been established in Kristiansand, South Norway, to carry out the extensive planning and engineering work required. The interconnector will have a capacity of 1400 MW and a voltage level of 450-500 kV. The cable will be one of the longest subsea cables in the world, crossing at a maximum depth of 410 metres. It will be based on advanced technical solutions as well as experience from other HVDC submarine cable projects with similar characteristics. If the necessary government approvals are forthcoming as expected, the cable could be operational in late 2015 or early 2016.

In June 2010 the Norwegian state-owned TSO Statnett joined the project and took a 50 per cent ownership interest in NorGer. Statnett's co-ownership means that NorGer will be developed as a merchant line seeking revenue exemptions from the basic EU regulation covering interconnectors. Capacity in the cable will be subjected to hourly implicit auctions, and there will be full third party access with no preferences for power from the owners.

The change in ownership has led to NorGer filing a revised application for the necessary permits in Norway jointly with Statnett's NordLink project. Currently the applications for the necessary concessions and permits to start construction are under consideration by Norwegian and German regulators. The same is true of applications for revenue exemptions. Assuming the necessary government approvals, the NorGer cable could be operational in late 2015 or early 2016.

1.4. "Baltic Sea Initiative" needed

The European Coordinator recommends that the European Commission considers launching an initiative aiming at the coordination of joint offshore grid development in the Baltic Sea. This new initiative should build on results already achieved by the Baltic Energy Market Interconnection Plan (BEMIP)⁵ in order to avoid duplication of work; it should also aim at using existing structures within the region, e.g. the BEMIP itself.

The scope of such an initiative should include the following:

- Assessment of the need to further align regulatory elements with regard to offshore grid development (BEMIP already deals with regulatory harmonization)

⁵ http://ec.europa.eu/energy/infrastructure/events/doc/2009/2009_11_25_hlg_report_170609.pdf
Please note that the Kriegers Flak project is proposed as an interconnection project in the BEMIP.

- Continuation of the market development and integration process
- Creation of a common planning and licensing procedure for integrated Baltic Sea networks.

The preliminary work and results of the NSCOGI should be taken into account in order to finalise the initiative by the end of 2012.

This means that, by the end of 2012, the planning conditions and economic considerations would be in place to enable the investment necessary to integrate offshore wind energy in the North and Baltic Seas into a future EU internal electricity market.

1.5. Regional potentials

In order to assess the possible added value of offshore electricity generation technologies and the resulting challenges facing a European integrated grid, it is necessary to look at European regional potentials. The North Sea has different conditions and potentials for the generation of renewable energy. Scotland is a fine example of how different offshore technologies (wind parks, wave and tidal technology, onshore potentials, various wind potentials) can be combined to form a coherent approach. To be able to use all these elements as part of a European sustainable energy policy, these Scottish renewables have to be connected to an integrated European grid. According to experts, offshore capacities of up to 68 gigawatts can be installed in the North Sea off Scotland by 2050. This can therefore become a key region in the use of offshore potentials. The EU Coordinator will continue his discussions with the Scottish experts so as to clarify the economic and regulatory aspects required for an integrated European offshore grid.

1.6. Maritime Spatial Planning: A necessity

Maritime Spatial Planning (MSP)⁶ is a new concept already widely applied globally for the integrated planning of maritime use in order to balance sectoral interests and use space more efficiently, but also to ensure greater certainty for large-scale maritime investments. These issues are all fundamental in particular for those maritime sectors that rely on access to large sea areas, e.g. offshore renewable or non-renewable energy, shipping or IT infrastructure. All these seek a good economic return instead of a complicated, uncertain and changing scene that ties up large resources and scare away investors. MSP is a public process of analysing and allocating spatial and temporal distribution of human activities in marine areas to achieve economic, ecological and social objectives that are usually specified through a political process. In practice MSP is about providing jobs, economic benefits, legal certainty, equal opportunities for all maritime sectors and environmental sustainability. All these benefits are top priorities for the EU Commission and for the Member States. At present one of the main drivers that allows us to pursue such benefits is offshore renewable energy.

Offshore cross-border renewable energy installations suffer from differences and lack of coordination in maritime governance which slow down the process and increase the risk of conflicts between sea-users. For offshore cross-border energy installations a maritime spatial planning framework should be applied to ensure a straight-forward, coherent but also a more informed planning basis in order to facilitate faster and more predictable approval of large scale energy installations, and more effective and coordinated

⁶ Study on the economic effects of Maritime Spatial Planning (DG MARE, April 2010)

governance, planning and management. At Member State level, "one-stop-shop" decision making would speed up the MSP and the approval process significantly.

The EU Coordinator recommends that the Commission and NSCOGI coordinate the ideas of DG MARE and the North Sea littoral states. There is no alternative to achieving the necessary coherence between all concerned in the use of the North Sea for a sustainable European energy supply.

2. FINANCIAL AND REGULATORY ISSUES OF THE OFFSHORE GRID (ACTIONS 2 & 4)⁷

Substantial investment in electricity networks both offshore and onshore will require the right regulatory framework, particularly with regard to cross-border investments.

The European Coordinator has already mentioned⁸ that investments will only be possible if the regulatory regime takes developments on the financial and capital markets into account. The investment regime must be adapted accordingly to ensure consistency and transparency when remunerating investments across the North Seas region.

The idea of having a "**knowledge pool**"⁹ at supranational level could assist the national regulators in their rate-making decisions. Moreover, proposals for **new incentives** have to be considered.

2.1. A supranational "knowledge pool"

Deciding on a fair remuneration for investments is a difficult task where national regulators could benefit from assistance from a supranational body. This problem could be solved by setting up a neutral "knowledge pool" at regional or European level or among a number of countries willing to cooperate in this way.

A number of reasons can be identified for setting up a knowledge pool:

- *The broader context of financial markets:* Awareness of this broader financial market context is important, but knowing how to handle and understand it is an even bigger challenge. Infrastructure project developers face competition from other industries when seeking the required funding, whether it is based on equity or debt. Investors are looking for a good risk-reward balance and are not merely interested in the electricity transmission business. Gaining expert knowledge and pooling that knowledge can facilitate the crucial aspect of funding.
- *An unprecedented challenge:* The upcoming investment challenge in the context of offshore wind is unprecedented due to its clearly cross-border nature, the technologies used and the very different reasons for the investments. This implies a change compared to previous projects and calls for a close examination of the risk-reward balance. The small amount of experience available should be brought together to the benefit of everyone facing this challenge.
- *Lack of information:* Due to the small number of transmission and cross-border projects completed at the extra high voltage (≥ 220 kV) or HVDC level in Europe over the past two decades, the experience of national regulators in this area is rather limited (especially for offshore grid projects). Bundling this experience and combining all

⁷ Prof. Belmans and Patrik Buijs, Katholieke Universiteit Leuven (See Annex 4)

⁸ http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2009_off_shore_wind_annual_report_en.pdf

⁹ A 'knowledge pool' refers here to an expert group, commission, advisory board, etc.

available knowledge in a single body could provide national regulators with solid backup when taking their decisions.

- *Independence from the national situation*: When setting transmission tariffs, national regulators face pressure from the public or politicians to keep transmission tariffs low. However, this short-term thinking jeopardizes medium and long term welfare which can only be increased by investing. Grid tariffs are in fact the last aspect of the total electricity price that is not left to the market.

A "knowledge pool" could:

- Serve as a database which centralizes all relevant information concerning major European and worldwide infrastructure projects.
- Perform a benchmarking analysis using the information on different projects. The result of this exercise can include appropriate rates for 'typical' transmission infrastructure projects (e.g. offshore platforms at a particular distance and depth, overhead lines under typical geographic conditions).
- Make rate-of-return proposals for specific projects upon which national regulators have to decide. Such a proposal can be issued under an 'accept-or-explain' rule, i.e. national regulators either accept the proposal or explain publicly why they decide to set a lower or higher rate. As rates for specific projects are issued in such a mechanism, this effectively constitutes 'single-issue' rate-making.

2.2. Possible incentives for promoting regional onshore/offshore grid development

Promoting onshore and offshore grid development requires sufficient incentives, including financial ones. A number of possibilities are presented below. Some of these result in 'single-issue' rate-making. This means that under certain conditions separate rates could be applied to parts of a TSO's asset base. Good and objective criteria for eligibility are of course necessary to rule out any lobbying and subjectivity in rate-making.

- *Higher return on equity*: Granting an extra return on equity for a particular set of projects, e.g. projects of European interest, can promote these investments. This helps remove possible cost disadvantages such as more complicated procedures in the case of cross-border projects.
- *Recovery of construction works in progress*: Some projects have long lead and construction times, requiring major upfront investments before projects enter into operation and are added to the Regulated Asset Base. Allowing the addition of these costs (that actually lead to concrete operational investments) to this Regulated Asset base at an early stage can ease the financing burden of large projects.
- *Recovery of abandonment costs*: When TSOs have to proactively invest in transmission infrastructure they may end up with stranded investments when ultimately the facilities are not used. Guarantees to accept the investments into the Regulated Asset Base even after (potential) users have abandoned the facility can lower the investment risk. Obviously, careful assessment is needed that only prudently incurred costs can be recovered. Therefore, a thorough cost-benefit analysis taking into account the chances of ending up with only a partial use of the facility is required (e.g. using real options analysis).
- *Incentives for optimum use of assets*: The cost of using the assets should not be overlooked. When TSOs can choose between two technologies, the one with an overall lower total cost of ownership (taking into account all costs, i.e. social costs) should be opted for even if they today have no incentive to do so. Tasking the TSOs to

demonstrate the benefits allows the promotion of innovative solutions not always captured by specific remuneration schemes purely on the basis of the investment costs.

- *Promoting TSO cooperation*: A possible way to do this is by, for example, providing extra remuneration and extra rate-of-return for TSOs willing to go beyond what is required by the ENTSO-E operational handbook¹⁰ (which in fact defines the minimum level of cooperation). Obliging TSOs to demonstrate the benefits keeps the door open for innovative solutions that are not always captured by specific legislative initiatives.

3. PLANNING AND AUTHORISATION PROCEDURES¹¹ (ACTION 3)

The EU's sustainability strategy is based on

- the protection of natural spaces, flora and fauna, and
- a climate policy with clear objectives for a sustainable energy policy.

Under existing EU law the relationship between environment protection (particularly nature protection) and Europe's interest in constructing transmission networks to integrate renewable energies, increase cross-border trading in electricity and ensure security of supply is fraught with uncertainty. This leads to difficulties in balancing the two elements and to excessive delays in implementing EU law, above all with regard to planning and approval procedures, on the part of the Member States.

The potential conflicts between

- Community protected areas and
- grid projects of common interest

have been examined in detail for the first time in Professor Lecheler's expert opinion drawn up for the EU Coordinator.

The two goals contradict each other under EU law, although both are core elements of European sustainability policy. The Member States' decisions in weighing up nature protection and grid construction legislation require that the legal authorities resolve these contradictions, although they are laid down in Community law.

The European Council, in point 3.2.3 of the Green Paper "Towards a Secure, Sustainable and Competitive Energy Network", called on the Commission to "table proposals aiming at streamlining approval procedures" for network projects. The Green Paper's plans and assessments refer above all to improving the coordination of the various national approval procedures and removing administrative hurdles.

This approach has now proved to be insufficient. Point 4 of the Green Paper (Conclusions) lists the resulting consequences: *"As set out in the Commission's second Strategic Energy Review and elaborated here, the EU will be unable to deliver its climate and energy goals without new and improved networks. Energy networks must take a more prominent place in energy policy development and implementation."* To arrive at a potential solution it is important to look at European legislation.

10 Here not only technical issues but also market issues are meant.

11 Prof. Lecheler's report and proposals, Freie Universität Berlin (See Annexes 2 and 3)

However, the legal consequences remain unclear and make grid planning and approval procedures more difficult, as shown by the wording of the new Title XXI (Energy; Article 194 TFEU), according to which EU policy on energy, "with regard for the need to preserve and improve the environment", shall aim to:

- a) ensure the functioning of the energy market;
- b) ensure security of energy supply in the Union;
- c) promote energy efficiency and energy saving and the development of new and renewable forms of energy; and
- d) promote the interconnection of energy networks, without weighting them.

But Member States cannot be left to resolve these Community law conflicts.

It is up to the secondary legislator to clearly state its preferences in the specific relationship between environmental protection and the need for secure energy supply and the resulting requirements for grid construction. The justification for declaring the inapplicability of any contradictory environmental protection legislation is that the weighing up has already taken place when categorising a grid construction project as being in the "common, priority or European interest".

For these reasons the EU Coordinator proposes further measures to clarify the relationship between environmental protection under EU law (particularly nature protection) and Europe's interest in constructing transmission networks to integrate renewable energies, increase cross-border trading in electricity and ensure security of supply.

The aim is to ensure that grid construction and expansion projects recognised under European law as being in the common, priority or European interest do not contradict European environmental legislation.

At the end of Prof. Lecheler's expert opinion (see Annexes 2 and 3) this proposal is favourably examined from the European law perspective.

4. MARKET DESIGN TO SUPPORT OFFSHORE GRID PLANNING AND OPERATIONS¹²

The European Coordinator invites the NSCOGI to examine the analysis made in this chapter on the EU power market design which affects both the planning and operations of onshore and offshore grids. Hence it is essential to ensure that a suitable power market design is in place.

The North Seas offshore grid offers the opportunity to address four key problems which, if solved, could provide long-term and far-reaching benefits to the European power market: improving congestion management mechanisms between and within countries; providing appropriate regional power price signals to encourage timely and suitable onshore and offshore transmission expansions/upgrades; agreeing an integrated approach to offshore DC interfaces to limit possible operational shortcomings; and increasing market flexibility to deal with intermittency on shorter timescales.

After comparing different EU power market designs, we identified that an approach using nodal pricing provides appropriate price signals for the economic design, evaluation and planning of offshore grids, and encourages the effective use of

¹² K. Neuhoff and R. Boyd, Climate Policy Initiative, for Mr Adamowitsch, European Coordinator (See Annex 5 for details of our work on evaluating nodal pricing in an integrated EU power market).

transmission capacity whilst improving interfaces between onshore and offshore networks. The North Seas Countries' Offshore Grid Initiative offers a suitable forum to promote the joint commitment of all relevant stakeholders to advance an effective and sustainable power market design.

Congestion Management

A market-based, uniform and efficient transmission capacity allocation mechanism is essential. This mechanism has to manage congestion, both between and within countries, while avoiding the possible abuse of market power. European transmission system operators (TSOs) currently utilise a non-market based approach to congestion management within their country or control area. The unlimited use of national transmission capacity is granted by system operators to all installations connected to the network.

However, since capacity is a finite resource, generators are subsequently paid by system operators to reduce their use of transmission capacity when constraints occur. The resulting costs are wholly borne by transmission operators, and in turn by the consumer, meaning that the current market design is not only expensive and inefficient but also creates perverse incentives to delay new generation connections and off-shore grid investment, e.g. by limiting the effort put into planning processes. In addition, the approach encourages generators to schedule an increase in output, so that they will then receive payment to reduce generation at the constrained location (also known as the increase-decrease or 'inc-dec game')¹³.

Appropriate Regional Pricing

Because of the zonal nature of the existing power market design (outside Scandinavia), prices only change at national borders, even though most congestion occurs on lines within countries. Hence, with the wrong price signals, it is difficult to identify economic benefits and design an effective, common offshore grid infrastructure. Transparent price signals are particularly important for modular designs that need to demonstrate benefits at each stage.

Offshore DC Interface

Offshore DC links will be connected to various locations of the onshore AC power system. The operation of the DC system significantly influences flow-patterns in the onshore grid and may increase local congestion. While national TSOs aim to reduce national congestion, it is important to ensure that the operation of DC links does not lead to increased interconnector congestion. Therefore, it is essential that an agreement is reached on a methodology for the operation of all DC interfaces prior to the design of the offshore grid.

Incorporation of Intermittency

Short-term balancing services need to be delivered across borders and have to be integrated with congestion management. The North Seas grid will be primarily designed to connect and transmit wind power. Wind output is relatively uncertain in day-ahead forecasts, but improves towards high levels of accuracy four hours prior to real time. The maximum value of wind power and offshore grids can be realized if a flexible power market design fosters systemwide optimisation across all actors within a short time-

¹³ Such an inc-dec game broke the Californian power and UK gas market prior to the introduction of effective congestion management.

frame. For instance, Spain succeeded in keeping demand for balancing services constant despite the large increase in wind deployment and the almost 'island' nature of the grid. If applied at European scale, such a platform would have to be fully integrated with congestion management. This would allow for the flexibility of onshore and offshore grid infrastructure to balance wind volatility across Europe.

In an assessment by the European regulators' group for electricity (ERGEG)¹⁴, a nodal pricing approach was considered the "ultimate goal and (technically and economically) optimal solution", but only adjustments to the current power market design were subsequently proposed for consultation. The experience in several deregulated power and gas markets¹⁵ show that designs that do not appropriately address transmission constraints, or do not offer a consistent approach for integrating day-ahead and real-time energy trading, can be subject to market failures, including gaming and blackouts. This introduces significant onshore and offshore regulatory uncertainty that potentially undermines investment and innovation, since future changes to regulations can be expected, but neither their timing nor exact nature is clear to market participants. Thus, the early adoption of a robust power market design that is compatible with large scale renewable deployment is necessary, and requires committed effort with a long-term perspective.

5. TECHNICAL ISSUES

5.1. Partial undergrounding vs. overhead line in the grid¹⁶

In his 2009 Report on the TEN-E "380 kV Salzburg Line" project, the EU Coordinator discussed the various technical merits of partial undergrounding as against overhead lines. For this particular project the Coordinator found that partial undergrounding was not feasible. This led to a heated debate, particularly with Europacable, the European association of cable producers. On the suggestion of the Coordinator the then Energy Commissioner, Andris Piebalgs, asked ENTSO-E and Europacable to arrive at a common assessment on this issue, taking technical and safety aspects into consideration. In November 2010 the two associations submitted a joint paper in which these questions were discussed and assessed. The main elements can be summarised as follows:

- The objective of this joint document is to provide an authoritative source of information for future transmission projects, which shall be made available to any interested party.
- It provides information on the feasibility and technical aspects of partial undergrounding of Extra High Voltage (EHV) transmission lines (AC 220 kV - 400 kV) based on the expertise of cable systems manufacturers and on the experience gained by the European Transmission System Operators with the inclusion of underground EHV cables in their systems.

¹⁴ European Regulators' Group for Electricity and Gas - Initial Impact Assessment for the Framework Guidelines on Capacity Allocation and Congestion Management, Ref: E10-ENM-01-01-CM_FM_IIA, page 30. Dated 08 September 2010.

¹⁵ Such as those in several US states. To resolve these market failures, these areas implemented a nodal pricing model which eventually extended from several northeastern US states to neighbouring states; recently it was adopted in Texas and California.

¹⁶ Joint paper ENTSO-E, Europacable (See Annex 7)

- The document focuses on the use of 400kV XLPE cables, a technology that performs well based on established international standard IEC¹⁷ 62067 and is available for transmission projects.
- It is recognised that each transmission project is unique due to its specific features. Given the complexity of integrating partial undergrounding into high voltage transmission systems, all projects require a case by case analysis of the technical specifications.
- From a technical perspective, partial undergrounding can be a viable option for transmission projects of vital interest for the development of the EU transmission network.
- Reliability and costs are of the highest importance. The use of IEC standards for testing and qualification aims to ensure the reliability of the cable systems. Monitoring systems are available to further increase reliability. Depending on the type and scope of failure, repair times for cables can be longer than for overhead lines. As with any transmission link, also partial undergrounding requires a risk assessment by the Transmission System Operator of integrating the link into the system.
- The Underground Cable (UGC) investment cost is typically 3 to 10 times higher than Overhead Line (OHL) costs (and more if specific structures are needed). Where partial undergrounding is considered, the above multiples apply to the undergrounded part of the link; therefore any decision for partial undergrounding needs to take the economical balance of the total transmission project into account. Such a decision must also be carefully analysed with all stakeholders, in particular the regulators, whose authorization is in many cases needed by the TSO to ensure an appropriate cost recovery through the transmission tariff.
- The case study provides an example of UGC dimensioning in order to comply with the requirements of a typical double circuit 400kV OHL carrying 2*2500MVA which can be considered today as a typical solution used for the development of the European transmission system. It shows that four cable systems would be generally needed leading to a corridor of 20-25 metres on which no deeply rooted trees may be planted and to which appropriate access must be managed.

The EU Coordinator considers that the findings of this joint paper fully bear out his recommendations for the 380kV Salzburg Line project. The paper will help clarify the debate on partial undergrounding versus overhead line in future transmission projects.

5.2. HVDC standardization¹⁸

Standardization of several aspects of an HVDC grid would increase the interoperability and the integration of a future meshed DC grid.

At the very least the voltage levels would have to be standardized, as would the following elements: cable sizes, the size of the offshore platform and the area of a single unit, the volumes of system elements (transformers, switchgears, etc.) and the voltage control.

For optimum interoperability, elements like power electronics components, filters, short circuit current, protection and communication may be standardized.

¹⁷ International Electrotechnical Commission

¹⁸ Prof. Belmans and Patrik Buijs, Katholieke Universiteit Leuven (See Annex 4)

5.3. Offshore grid development using DC/DC transformers¹⁹

The development and the realisation of an offshore grid will only be possible if some technical barriers can be removed. Already in his second annual report of December 2009, the European Coordinator mentioned that technical feasibility of multi-terminal HVDC technology and capacity is not yet proven. Also power control and protection schemes, as well as DC breakers have to be developed.

During the last Adamowitsch Working Group meeting in Edinburgh, the University of Aberdeen gave a very interesting presentation on a concept related to the development of a DC transmission network using DC/DC transformers.

No meshed DC grid has been installed anywhere in the world. All existing HVDC systems operate today as point-to-point interconnectors, and only experimental work has been done on T-type connections. There are no operational multiterminal HVDC systems or high-power DC transmission networks.

Although these are well proven concepts with AC networks, the main technical challenges with DC networks are linked to DC fault isolation and the equipment necessary to ensure grid security/reliability (DC circuit breakers) and DC voltage stepping (DC/DC convertors).

The University of Aberdeen has developed a technology concept for a DC substation based on Power Electronics capable of overcoming the technical challenges described above and which can also be used as a DC power flow regulator. A multiterminal DC substation is therefore possible and would be able to connect multiple DC lines of different voltages, isolate faults and regulate power independently on each DC terminal. The Aberdeen team is currently developing scaled-down hardware prototypes in the laboratory.

6. REPRESENTATION OF EUROPEAN COMMISSION INTERESTS BY THE EUROPEAN COORDINATOR

6.1. Salzburg Line (Austrian Power Link)²⁰

Since the EU Coordinator's Report of July 2009 on the Salzburg Line there has been a comprehensive discussion between the politicians responsible for the project and the APG TSO regarding project realisation. The EU Coordinator is confident that this TEN-E project can be realised. APG is reporting to DG Energy on the status of consultations.

The measures proposed by the EU Coordinator aimed at achieving both greater transparency regarding the need for the planned line and greater acceptance of that line, particularly among the local authorities and population, can be found in the current discussion report. The aim of all concerned is to seek the broadest possible consensus on planning and authorisation issues prior to the relevant procedure for this TEN-E project in order to make that procedure less complex. Involving civil society in this process is highly important. This procedure is important to DG Energy for the following reasons:

- the debate is based on the EU Coordinator's suggestions;
- the involvement of all parties, including civil society, will result in acceptable proposals for the line routing and the authorisation procedure;

¹⁹ Dr Dragan Jovcic, University of Aberdeen (See Annex 6)

²⁰ Salzburgleitung – Zwischenbericht (interim report) (See Annex 7)

- the DG will, in flanking and assessing this process, gain valuable clues about fulfilling the demands made in the Energy Infrastructure Package, i.e. to increase the transparency of planning and authorisation procedures for extra-high voltage transmission lines in Europe;
- the joint ENTSO-E – Europacable working paper on the undergrounding of EHV transmission lines will clarify what is often a heated discussion.

6.2. Thüringen Line: Hearing of the Thuringian State Parliament

During the past three years the EU Coordinator has made intensive efforts to promote TEN-E project 3.49 Halle-Schweinfurt, as this line, which closes a gap, is essential for the integration, into the European network, of renewable electricity from Scandinavia, the Baltic Sea and the German Länder bordering the Baltic.

In this project, as with the Salzburg Line, the EU Coordinator has identified a lack of cohesiveness between European policy and the energy industry. This particularly applies to the fact that, since extending the transmission grid is vital to the implementation of the European climate goals, the need for which is publicly accepted, implementation is thus encountering acceptance problems.

In order to solve these problems, the EU Coordinator feels that strategies have to be drawn up so as to build the broadest possible consensus in favour of these projects prior to the planning and authorisation procedures. However, the European conditions for the sustainable protection of natural areas on the one side and the creation of an appropriate infrastructure for a renewables-based energy policy on the other also have to be coordinated. During a parliamentary hearing in Thuringia on 18 May 2010 the Coordinator pointed to the European dimension and the essential nature of this high-voltage line. He also explained that the TSOs such as 50 Hertz could only meet their obligation to provide for an uninterrupted electricity supply if the politicians guaranteed that the legal framework for grid construction and extension was in place. In its 10-year grid plan ENTSO-E states that over 40 000 km of new lines are needed in Europe.

These correlations have to be more strongly emphasised, also in regional discussions, so as to make the connection between the need for climate protection and the vital need for new electricity lines. The EU Coordinator is closely consulting with the Thuringian state government and 50 Hertz in monitoring the progress of this project. The presentation of the joint paper by ENTSO-E and Europacable, at the initiative of the EU Coordinator and DG Energy, is expected to clarify the issue of whether the planned line should be partly undergrounded. During the hearing in the Thuringian state parliament the Coordinator also pointed out that the TSO and the European Commission could initiate infringement proceedings if non-implementation of this project endangered supply security.

7. CONCLUSIONS AND WORK PROGRAMME 2011

The integration of the North and Baltic Seas' offshore potentials is vital to the development of a European internal energy market. The ambitious European and national climate and energy goals cannot be achieved without an integrated grid strategy. To create the conditions for a Europe-oriented linkage of these offshore potentials, basic issues of

- cross-border regulation
- planning and authorisation prerequisites
- technical prerequisites
- financial conditions and

- criteria for a functional European internal market in electricity must be analysed.

The EU Coordinator supports the intention of the North Seas Countries' Offshore Grid Initiative (NSCOGI) to formulate this analysis by the end of 2012.

The NSCOGI Member States have decided to involve the EU Coordinator's informal "Adamowitsch Working Group" in this process in order to assist in discussing the abovementioned issues.

Annex 1: List of events / persons met

Date, Place	Event/Main contacts	Objective
2009		
24.11, Papenburg	"BorWin1" project-final Dr Dierk Paskert (Transpower), Dr Joachim Schneider (ABB), Dr Christof Schulte (Transpower)	"BorWin1" – The first German network connection of an offshore wind park in direct current technology
25.11, Brussels	Second annual report preparation Mr Patrick Bourrel	Define the outlines and the content of the second annual report
16.12, Brussels	Working group for Offshore/Onshore grid development - 5th meeting Adamowitsch Georg, Belgacem Karina, Blanchard Loïc, Bourrel Patrick, Broekhuizen Kleis, Brodach Georg, Christensen Peter Wibæk, Corbett Joe, Courcambeck Alexandre, Crouch Martin, Deloof Frederik, Denruyter Jean-Philippe, Birksien Eric, Doornbos Imar, Fichaux Nicolas, Gassner Holger, Geul Ton, Giraut Ruso Elizabeth, Green Diane, Green Colin, Hensmans Jan, Højgaard Kristensen Anders, Hauglum Kjartan, Koch Hermann, Kortegaard Nielsen Hanne, Krummer Frank, Ladefoged Niels, Luther Matthias, Mc Caffrey Barry, Manzanas Raul, Neilson Paul, Orths Antje, Overton John, Prochaska Sven, Reinisch Rüdiger, Schiel Johannes, Schneiders Thorsten, schwartz Jean-Claude, Serres Etienne, Thiele Anika, Troy Marian, Van Biert Teun, Vande Putte Jan, Verbeeck Jan, Vermeylen Annemie, Veum Karina, Völker Jakob, Wilczek Paul, Woyte Achim, Weber Christoph, Yao Liangzhong	Presentations to the group on following topics: - Initiatives and Status of grid development - Studies and recommendations - Policy, Regulator and ENTSO-E - Technical aspects Open and transparent discussions Discussion on the Work Plan for 2010

Date, Place	Event/Main contacts	Objective
2010		
11.01, Berlin	Meeting in the Federal Ministry of Economics and Technology Mr Detlef Dauke (Director General, Head of Department Energy Policy), Dr Michael Frass (Office of State Secretary Jochen Homann), Dr Tobias Pohl (Energy law/Electricity and Gas Regulation), Dr Arne Genz (Electricity Industry)	Follow-up of the signature on 7.12.2009 of the North Seas' Offshore Grid Initiative Political declaration at German level
20.01, Brussels	Second annual report Mr Patrick Bourrel	Finalise the Second Annual Report
23.03, Brussels	Visit of Mr Adamowitsch to DG TREN Mr Lowe (Director General)	To present himself and his work to the new Director General of DG TREN
24.03, Brussels	Working group for Offshore/Onshore grid development - 6th meeting Adamowitsch Georg, Blanchard Loïc, Bohl Mie-Lotte, Bourrel Patrick, Brodach Georg, Cagney Denis, Carty Siobhán, Cooke Richard, Dale Lewis, Deloof Frederik, Doornbos Imar, Dunon Frederic, Ekebom Jan, Elsevier Van Griethuysen Dolf, Foresti Marco, Gassne Holger, Genz Arne, Geul Ton, Giese Oliver, Harenberg Jens, Hauglum Kjartan, Hercsuth Andrea, Jackson Mike, Kreutzkamp Paul, Krummer Frank, Løvstad Tommy, Luther Matthias, Manzanas Raul, McCoy Natalie, McElhinney Michael, Neilson Paul, Orths Antje, Otjacques Stephane, Prochaska Sven, Reinisch Rüdiger, Rocher Viola, Schneiders Thorsten, Schultze Alberto, Schüssler Sebastian, Schwartz Jean-Claude, Schwencke Tilman, Sorensen Erik Kjær, Tretvoll Bjørn, Van Der Welle Adriaan, Van Hulle Frans, Vande Putte Jan, Vermeyleen Annemie, Verseille Jean, Vessia Oyvind, Vinois Jean-Arnold, Weber Christoph, Wilczek Paul, Wilkes Justin, Winter Wilhelm, Woyte Achim	Presentations to the group on following topics: - Initiatives and status of grid development - Policy, regulator and ENTSO-E - Studies and recommendations - Technical aspects Open and transparent discussions

29.03, Vienna	<p>Visit of Mr Adamowitsch to Vienna on 29 March 2010 to meet Representatives of the Austrian Federal Ministry for economics, family and youth Dr Matthias Neubauer, Dipl.-Ing. Dr. techn. Gerald Vones, Mr Peter Dickinger</p> <p>Meeting with representatives from APG Verbund Mr Wolfgang Anzengruber, Mr Heinz Kaupa, Mr Gerhard Christiner</p>	Follow-up on the progress of the planned 380 kV line in Salzburg
27.04, Billund / Århus	<p>Visit of Mr Adamowitsch to Billund and Århus and meeting with representatives from Vestas Anders Søe-Jensen (President, Vestas Offshore), Peter C. Brun (Senior VP, Group Government Relations), Erik Kjær Sørensen (Director, Group Government Relations), Per Holmgaard (Senior Power Sector Specialist, Group Government Relations) Peter Wibæk Christensen (Development Engineer, Technology), Annika Thiele (Policy Analyst, Group Government Relations)</p>	<p>Visit the Blades Production Business Unit in Lem (near Billund) and the Turbine Test Centre (Århus)</p> <p>To discuss the development of the offshore project at the Technology and R&D Centre (Århus) .</p>
17.05, Berlin	<p>Meeting with representatives from 50 Hertz Mr Schucht (Managing Director CEO), Mr Neldner, (Managing Director), Mr Dorny, Mr Bogenrieder, Mr Smirk, Mr Radtke, Mr Ziemann, Mrs Wulfers, Dr Sassnick</p>	Hearing preparation in Erfurt
18.05, Erfurt	<p>Hearing at the Thuringian state parliament (Landtag) Members of the Economics, Technology and Labour Committee</p>	<p>Public hearing organised by the Landtag on the topic of: "Notwendigkeit des Baus der 380-kV-Leitung durch den Thüringer Wald" (Need to build the 380 kV line through the Thuringian Forest)</p> <p>This project is a Project of European Interest in which Mr Adamowitsch was already involved last year.</p>
20.05, Aberdeen	<p>The All-Energy 2010 Conference Mr McElhinney (Head of Energy Projects, The Scottish Government), Dr McWilliams (Energy Markets, The Scottish Government), Mr Marais (The Crown Estate)</p>	Keynote address by Mr Adamowitsch

28.05, Madrid	<p>High Level Conference on European Energy Infrastructure Organised by the Spanish Presidency and the European Commission</p> <p>Commissioner Oettinger, Ms Paula Pinho (Member of cabinet), Mr Philip Lowe (Director-General for Energy), Mr Heinz Hilbrecht (Director Security of supply, Energy markets & Networks), Mr Christophe Schramm, Mr Patrick Bourrel, Mr Jacques Huchet (EU Representation in Madrid)</p>	Bilateral meeting with Commissioner Oettinger on offshore grid development (financial and environmental aspects)
02.06, Brussels	<p>Preparatory meeting for the Working Group</p> <p>Mrs Catharina Sikow-Magny, Mr Christophe Schramm</p>	The Adamowitsch Working Group meeting on 14 June 2010 was dedicated to the "Energy Infrastructure Package"
14.06, Brussels	<p>Working Group on the "Energy Infrastructure Package"</p> <p>Adamowitsch Georg, Belmans Ronnie, Blisson Natacha, Bohl Mie-Lotte, Bourrel Patrick, Cassidy Daniel, Doornbos Imar, Dunon Frederic, Gassner Holger, Genz Arne, Green Diane, Gulliver Hazel, Heer Katharin, Holmgaard Per, Holst Jakob Lau, Johnston Mark, Krummer Frank, Lopez-Nicolas Antonio, Lovstad Tommy, Marinus Lieselot, O' rourke Robert, Orths Antje, Paun Mihai, Quinonez varela Gustavo, Reinisch Rüdiger, Rocher Viola, Schirmer Mathias-Peter, Schneiders Thorsten, Schramm Christophe, Schwartz Jean-Claude, Schwencke Tilman, Serres Etienne, Smadja Guillemette, Steen Eivind H., Sykow-Magny Catharina, Van Hulle Frans, Vande Putte Jan, Veum Karina, Wilczek Paul, Wilkes Justin, Woyte Achim</p>	<p>To have an open discussion on grid development (offshore and onshore) on the following topics:</p> <ul style="list-style-type: none"> - Technical issues - Planning & authorisation - Financing & regulatory issues <p>Discuss the benefits of a "regional approach"</p>
16-17.06, Edinburgh	<p>Delivering on 2020 Conference</p> <p>Scottish Government</p> <p>Scottish First Minister Rt Hon Alex Salmond Jim Mather (Minister of Enterprise, Energy and Tourism)</p> <p>Economy Energy and Tourism Committee of the Scottish Parliament</p>	<p>Speaker at the conference</p> <p>Bilateral meetings to discuss the Scottish situation on renewable energies and specially offshore potential.</p>

21.06, Berlin	<p>Prepare the next "North Sea Countries' Offshore Grid Initiative" meeting (organised by the Federal Ministry of economy)</p> <ul style="list-style-type: none"> - BMWi: Dr Mühl, Dr Steinbach, Dr Genz, Mr Kröger - Hamburg: Mrs Kuczera - Schleswig-Holstein: Mr Schulz - Niedersachsen: Mr Schwarzenholz - BSH: Mrs Müller -50Hertz Transmission GmbH: Mr Reinisch - Transpower Stromübertragungs GmbH: Dr Luther, Dr Thimm - Amprion GmbH: Mr Barth - EnBW Transportnetze AG: Mr Neumaier - Dena: Mrs Agricola, Mr Völker 	The participants were invited to share their views on the development of an offshore grid in order to gain knowledge and to help to define the German standpoint in the initiative.
04.08, Bonn	<p>Meeting between BNetzA, 50 Hertz and Commission on the Kriegers Flak project</p> <ul style="list-style-type: none"> - Commission: Mr Adamowitsch, Mr Bourrel, Mr Schoser - BNetzA: Mr Kindler, Mr Hansen, Mr Paulus, Mrs Haller - 50Hertz: Mr Schucht, Mr Bespolka, Mr Schwarzbach, Mrs Ballauf - Elia: Mrs Meinshausen, Mr Weytjens 	<p>To inform the authorities of the state of play of the project planning.</p> <p>To clarify that according to 50 Hertz, its new shareholders (Elia and Industry Funds Management) continue to support the project.</p>
05.08, Leuven	<p>Katholieke Universiteit Leuven Prof. Ronnie Belmans, Mr Patrik Buijs</p>	Contribution to Mr Adamowitsch's work through an expertise on the subject of "Standardisation and Incentives"
24.09, Brussels	<p>Workshop of Offshore grid organised by the Commission Van Steen Hans (Head of Unit C1, DG ENER), Hercsuth Andrea, Hensmans Jan, Neuhoff Karsten, Wilkers Justin, Woyte Achim</p> <p>Working Group meeting and conference presentation preparation Bourrel Patrick</p>	<p>Address topics like: offshore plans and scenarios, grid design, regulatory framework, RES support policies, governance, NSCOGI.</p> <p>Preparation of the Working Group meeting of 28 September and the conference on 29 September in Edinburgh.</p>

28-29.09, Edinburgh	<p>Scottish Low Carbon Investment Conference Rt. Hon. Charles Hendry MP (UL Minister for Energy), Jim Mather MSP (Minister for Energy, Enterprise and Tourism, Scottish Government), Jose Perdigoto (Director General, Energy, Government of Portugal) Duncan Botting (Executive Chair and Interim CEO, SEGEC), David Walker (Development Director, Scottish Power Renewables), Erich Gunther (Founder and CEO, Enernex), Jim McDonald (Principal and Vice Chancellor, University of Strathclyde)</p> <p>Working group for Offshore/Onshore grid development - 7th meeting Bourrel Patrick, Marzin Andrée, Tretvol Bjørn H., Westman Bo , Meinshausen Christina, Dr Jovicic Dragan, Gulliver Hazel , Ekebom Jan, Jonathan Leucci, Mike McElhinney, Buijs Patrik, Henderson Robert, Reinisch Rüdiger</p>	<p>Speaker in a panel discussion on the "Future role of Government in Lowering Carbon Production"</p> <p>Speaker in a panel discussion on "Financing the Grid – Smart investment opportunities for managing the mix of distributed generation"</p> <p>Discussions on: - Technical issues and standardisation - Financial and regulatory framework - Maritime Spatial Planning</p>
06.10, Ostend	<p>Conference of the North Seas Countries' Offshore Grid Initiative Fauconnier Marie-Pierre, Lowe Philip, Kjaer Christian, White Sara, Dobbeni Daniel, Crouch Martin, Martens Filip, O'Connor Eddie, Soe-Jensen Anders</p>	<p>Explore how European policy makers can cooperate in order to ensure that the NSCOGI benefits from a framework of regional cooperation in terms of planning, financing and building future grid infrastructure, as well as tackling all technical, market, regulatory and policy barriers.</p>
03-04.10, Berlin	<p>Editing of the annual report</p>	<p>First final draft</p>

- Annex 2:** Harmonisierung des europarechtlichen Rahmens für den Bau von Übertragungsfernleitungen und für den Umweltschutz,
Prof. Dr Lecheler, Freie Universität Berlin,
August 2010
- Annex 3:** Vorschlag für eine möglichst einfache und effiziente Ergänzung des einschlägigen Sekundärrechts,
Prof. Dr Lecheler, Freie Universität Berlin,
September 2010
- Annex 4:** Suggestions for European Coordinator Mr Adamowitsch,
A note on standardization and incentives,
Prof. Belmans and Patrik Buijs, Katholieke Universiteit Leuven,
October 2010
- Annex 5:** Options for Europe: EU Power Market Design to Enable Offshore Grid
K. Neuhoff and R.Boyd, Climate Policy Initiative
October 2010
- Annex 6:** Developing DC transmission networks using DC/DC transformers,
Dr; Dragan Jovicic, University of Aberdeen,
October 2010
- Annex 7:** Feasibility and technical aspects of partial undergrounding of extra high voltage power transmission lines,
Joint paper ENTSO-E, Europacable,
December 2010
- Annex 8:** Salzburgleitung – Zwischenbericht,
November 2010

All annexes are available at:

http://ec.europa.eu/energy/infrastructure/tent_e/coordinators_en.htm

Section: "Baltic and North Sea off-shore wind connections"