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DELIVERING THE NORTH SEAS GRID
TOWARDS A REGIONAL FREE TRADE ZONE OF ELECTRICITY

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Summary

> Opening up power markets in the North Seas region and building the related offshore grid infrastructure is widely recognised to have major economic, security and environmental benefits - but progress is currently stalling. A new political mandate and a more focused approach to implementation and finance are needed.

> Over €100 billion is due to be invested in electricity transmission networks in the North Seas region over the next 15 years. This will allow interconnecting national electricity markets and creating a competitive regional electricity market, as well as connecting offshore wind farms to the grid.

> However, governments in the region are currently failing to deliver this investment effectively due to a lack of forward-looking regional electricity strategy for the North Sea's region. If existing arrangements are left unchanged, pervasive policy and regulatory risks will keep escalating costs and make many otherwise-sound investments untenable. A lack of coordination on grid design, development and finance mean that system costs will be between €25 billion and €75 billion higher over the next 25 years than under a more strategic and regionally coordinated approach.

> Within the new Energy Union framework Heads of Government and Energy Ministers of the North Seas region have the opportunity to provide the necessary political mandate for a renewed North Seas Grid regional initiative in order to strategically plan against future grid and power needs, coordinate implementation, and set up the investment mechanisms to overcome the existing financial concerns. The Commission should follow suit by proposing a strategic roadmap with a clear timeline for identification and implementation of priority projects, and set up a dedicated 'project team' in charge of brokering a ministerial-level agreement on key aspects of grid developments.

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> The challenge is within the ability of Governments to overcome. The scale of the opportunity has been widely recognised by energy companies, technology developers, grid operators, national and European politicians, economists and civil society organisations.[4] All the requisite technologies have been developed, and the global market is led by European manufacturers. The groundwork in mapping out the regulatory and planning requirements has largely already been done. However, real-world implementation has been painfully slow. Rapid agreement is needed on a new model for coordination to deliver maximum private and public value from infrastructure investment.

Context

It is six years since ten Governments signed a political declaration to work on the development of a North Seas Offshore Electricity Grid.[5] In the interim period a significant number of studies have shown the benefits that such an approach would bring in both developing our offshore wind resources and promoting better cross border trade in electricity.[6] The European Union has already established a network of transmission system operators (ENTSO-E) and energy regulators (ACER), and has included budget provisions to support large transnational energy projects. The European Council conclusions in March, June, October 2014 and March 2015 placed special emphasis on the urgent need for the development of electricity interconnection and better regional cooperation.[7] The proposed Energy Union framework by the European Commission reinforces the need of enhanced regional cooperation to increase security of supply, further accelerate fully EU-wide market integration, and to empower regional and city-level authorities and industries.[8] The Communication on delivering the 10% interconnection

[4] MEP Ian Duncan and MEP Bas Eickhout (March 2015) Energy Union – Realising A North Sea Grid **http://www.ianduncan.org.uk/sites/default/files/Energy%20Union%20-%20Realising%20a%20North%20Sea%20Grid.pdf**

Multi-stakeholders letter for Energy Ministers of the North Sea region (April 2015) North Seas Offshore Grid and Europe's Energy Union **http://e3g.org/docs/Energy_Council_Letter_NSG_7_April_2015.pdf**

[5] The ten countries are Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden, are UK. See: 'The North Seas Countries' Offshore Grid Initiative Memorandum Understanding' **http://www.ewea.org/fileadmin/files/library/publications/research-notes/MoU_definitief.pdf**

[6] Regulating Future Offshore Grids: Economic Impact Analysis On Wind Parks And Transmission System Operators, 2012 Lena Kitzing and Sascha T. Schröder Offshore Electricity Grid Infrastructure in Europe - A Techno-Economic Assessment 3E (coordinator), dena, EWEA, ForWind, IEO, NTUA, Senergy, SINTEF Final Report, October 2011

Offshore grids for renewables: do we need a particular regulatory framework? Author: MEEUS, Leonardo Series/Report no.: EUIRSCAS; 2014/24; Florence School of Regulation **http://hdl.handle.net/l 814/30078**

Poyvry management consulting: REGULATORY CHALLENGES TO CONNECTING TO GRID OFFSHORE - A report to The Crown Estate, November 2012

Study of the benefits of a meshed offshore grid in Northern Seas region, done by PWC, Tractebel Engineering and Ecofys for the European Commission, September 2014, **http://ec.europa.eu/energy/infrastructure/studies/doc/2014 nsog report.pdf**

Securing Options Through Strategic Development of North and Irish Seas Grid Infrastructure, July 2014, Imperial College London and E3G, Authors: Simon Skillings and Jonathan Gaventa, **http://e3g.org/x9Fwb**

The North Seas Countries' Offshore Grid Initiative Discussion Paper 2: Integrated Offshore Networks and The Electricity Target Model, **http://www.benelux.int/files/4514/0923/410Q/Market_Arrangements_Paper_Final_Version_28_July_2014.pdf**

The role of support schemes for renewables in creating a meshed offshore grid, policy brief, Fabio Genoese, Research Fellow at CEPS, April 2014 **http://www.northseagrid.mfo/publications/role-support-schemes-renewables-creatingmeshed-offshore-grid**

[7] European Council conclusions October 2014: **http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145356.pdf**
European Council conclusions March 2015: **http://data.consilium.europa.eu/doc/document/ST-11-2015-INIT/en/pdf**

[8] EC (2015) A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate

Change Policy **http://ec.europa.eu/priorities/energy-union/docs/energyunion_en.pdf**

target by 2020 recognises that regional cooperation must be brought to a higher level and the North Sea Regional Group should develop an Action Plan to increase interconnections.[9]

The North Seas Grid is a critical infrastructure project for the delivery of the multiple objectives of the 2030 climate and energy package and deliver a zero carbon power system by 2050: it would substantially increase the interconnection capacity between all North Seas countries while enabling access to large scale renewable energy which contribute to significant GHGs emission reductions and increase energy security. All this can be achieved at the lowest cost possible if a strategic grid and generation planning process as well as the right financing mechanisms are in place. It is therefore vital that Member States ensure that sufficient consistency exists between the various approaches adopted such that the move towards fully co-ordinated regional network planning is not delayed.

However, the reality is that progress has been frustratingly limited. Our electricity markets are still constrained by a lack of cross border coordination, which is also undermining the investment case for new grid and generation infrastructure. The economic benefits of combining offshore wind and interconnection infrastructure have been widely recognised, but in six years not a single combined project has reached Final Investment Decision, due to fragmented policy regimes. Without a new political impetus behind a strategic regional approach to the development of our electricity supply and market, we will be locked into an expensive, insecure and high carbon energy future.

Proposal

It is proposed that Energy Ministers of the North Seas region agree a new mandate and an electricity strategy for the implementation of the North Seas Grid as part of the enhanced regional collaboration within the Energy Union framework. A high level 'project team' should be built upon the existing North Seas Countries' Offshore Grid Initiative (NSCOGI) and be appointed to broker the necessary ministerial agreements. The new mandate would not require treaty change and would be introduced on the understanding that similar initiatives will also be developed in the Iberian Peninsula, the Baltic, and South East Europe regions.

The mandate should allow the Commission to establish a special 'project team' of 3-5 high-level individuals which would take on responsibility for brokering agreement on key aspects of grid development, finance and market design. The project team must be empowered to negotiate directly with Ministers and European Commissioners. The project team would be able to advance the work already done by the three working groups of NSCOGI, and should also be able to draw upon analytical and administrative support from the European Commission, ENTSO-E and ACER.

The project team would have the following three key objectives:

[9] EC (2015) A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy **http://ec.europa.eu/transparency/regdoc/rep/1/2015/EN/1-2015-80-EN-F1-1.PDF**
EC (2015) Achieving the 10% electricity interconnection target Making Europe's electricity grid fit for 2020 **http://ec.europa.eu/transparency/regdoc/rep/1/2015/EN/1-2015-82-EN-F1-1.PDF**

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1. Legal framework, strategy coordination, and regional network development

The project team should broker an Intergovernmental Agreement based on a shared North Seas offshore electricity strategy between Energy Ministers. This should define a high level political direction through setting clear objectives for the exploitation of offshore wind resources and for the regional development of offshore grid and interconnections in the North Seas as well as establishing a new regulatory institution with regional grid and investment oversight. These objectives should be in line with the agreed EU 2030 climate and energy framework, the Roadmap 2050, and associated governance mechanisms, including the Action Plan of the TEN-E Northern Seas Offshore Grid Regional Group supported by the Commission to deliver EU's interconnection targets. NSCOGI should convene a Ministerial meeting at the beginning of 2016 where a legal framework is formally agreed by the Energy Ministers during the Dutch Presidency.

The legal framework agreed by Energy Ministers should envisage the establishment of new institution with two core regulatory functions: oversight of strategic network design and authority to evaluate and approve future investment plans. This body would need to establish the future scenarios that will enable TSOs to plan grid development with particular attention to minimising the cost associated with accessing high levels of offshore wind development while interconnecting the markets. This body could be a new cooperative of regional regulatory authorities or be part of an expanded role for ACER, but it should be independent of transmission and generation ownership interests.

This agreement on high level strategy and objectives will also shape selection of infrastructure Projects of Common Interest in the region and allocation of Connecting Europe Facility finance to important investments.

2. Financing through a Special Purpose Vehicle

The cost of capital represents a significant proportion of the cost of offshore grid infrastructure, and political and regulatory risks are making projects more expensive.[10]

The North Seas Grid project team should therefore create of a dedicated investment platform in the form of a Special Purpose Vehicle for the North Seas Grid in order to maximize the mobilization of private sector capital on a regional basis. Over €100 billion is due to be invested in offshore infrastructure by 2030 (with the ability of paying back its initial investment cost within 1 to 3 years[11]). Within the new European Fund for Strategic Investment (EFSI), Member States and the Commission have already proposed 55 offshore wind, 30 offshore grid and 3 storage projects for a total investment value of at least €90 billion, €30 billion of which deployable between 2015-2017.[12] However, the current lack of coordination on infrastructure development is holding investors back from investing in the region.

[10] E3G / Baringa (2013) North Seas Grid Project Pipeline Analysis **http://e3g.org/x4mL**

[11] Tractabel Engineering, GDF Suez, Ecofys and PWC (2014) **Study of the benefits of a meshed offshore grid in the Northern Seas Region**.

[12] E3G analysis

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Such a structure should enable lower cost of capital through higher visibility and the scaling up of projects. It would also attract both private and public investment and enable to overcome TSOs' organisational capacity limits and balance sheet constraints. The project team should broker appropriate guarantees, for example through earmarking 20% of the granted EFSI's guarantees for offshore electricity infrastructure, in order to mitigate policy risks. It also needs to establish mechanisms for the allocation of cost and benefits for new electricity networks, recognising that in a regional grid certain 'anticipatory' investments will have to be made in the expectation of future long term needs.

3. Market Design

The implementation of the North Seas Offshore Grid will require market rules that facilitate trade in variable power supplies across interconnected markets. However, neither the 'Target Market' model for the integration of EU electricity markets nor the 'enhanced cooperation mechanisms' provided for in the Renewable Energy Directive, or the ETS have thus far facilitated cross-border trade in renewable power.

The project team should broker a regional 'North Seas renewables free trade zone'. Offshore renewables would be able to freely trade across borders on equal and transparent terms across any of the participating countries. This would enable offshore renewables to be located in the most cost-effective locations and for the power generated to be dispatched to where the demand is highest. It would also enable significant cost savings from optimised grid infrastructure.

Benefits

Energy Security

The ongoing dispute in the Ukraine has brought the issue of energy security to the forefront of European energy policy debates. Over a third of EU gas consumption currently takes place in thermal power stations. The development of offshore wind in the North Seas provides an important large scale option for reducing our future reliance on imported gas supplies, providing 4-12% of EU power consumption by 2030.[13]

Security of electricity supply can only be considered and assessed from a regional perspective because of the interconnections between Member States. Increasing interconnection is among the lowest cost options to increase electricity security as it would reduce the need to build new generation and use the existing capacity cost-efficiently. Germany would have a near 100% probability of balancing its system up to 2025 while reducing regional based load needs by 20 GW, were existing and planned interconnection capacity considered.[14]

[13] EC (2015) Achieving the 10% electricity interconnection target - Making Europe's electricity grid fit for 2020 **http://ec.europa.eu/priorities/energy-union/docs/interconnectors_en.pdf**

[14] BMWi (2015) Versorgungssicherheit in Deutschland und seinen Nachbarländern: länderübergreifendes Monitoring und Bewertung **http://bmwi.de/BMWi/Redaktion/PDF/Publikationen/versorgungssicherheit-in-deutschland-und-seinen-nachbarlaendern,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf**

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Interconnecting markets through an offshore grid is also a key tool for making the power system more robust against the risk of supply disruptions. Recent analysis shows that doubling UK interconnection capacity to 6 GW would remove the need for 3 new gas power plants while meeting the same level of security.[15] A meshed grid in the North Sea is therefore a critical strategic infrastructure for the security of supply in Europe through reducing the need of installed capacity by 8-19 GW compared to the current step-by-step approach.[16] The sharing of reserve capacities through the interconnections increases the reliability of the system. This mutual back-up assistance allows lower level of installed capacity requirements while still meeting the reliability planning criteria. This benefit is only realised if a coordinated approach to system reliability is taken.

Competitiveness

The balancing of variable power supplies across wider areas is essential for lowering the price of electricity in a future low carbon power system. There are large yet untapped EU-wide savings from cross-border coordination, with total gains of €40-€70 billion per year across Europe by 2030.[17]

Driving forward market integration at regional level is a key stepping stone for unlocking these benefits at European level. An integrated (or "meshed") approach to offshore electricity grid development in the North Seas lead to €25-€75 billion savings in operation and network investment costs[18] as well as €3.4-€7.8 billion in generation investment costs, lowering average cost of electricity production by 0.8-2.2 €/MWh.[19] However, if each country develops its own renewable power supply and network infrastructure independently from their neighbors, there will be no possibility for offshore wind generators to directly dispatch electricity to different markets other than that of the connected country. This will limit the opportunities for offshore wind providers to switch to different markets, thus limiting competition between countries. Through a national approach to infrastructure development the benefits from increased cross-border trade and system balancing will be missed, while we will have to provide expensive back-up generation and storage systems in each individual market.

These competitiveness benefits can be achieved with relatively low risk. The long-term future of offshore wind depends on achieving the cost reductions foreseen by industry. Over the medium term, however, judicious investment in offshore grid infrastructure to keep the offshore wind option on the table is effectively a one-way bet. The 'worst case' economic

[15] Poyry (2013) The impact of EMR on interconnection **http://www.poyry.co.uk/news/poyry-report-impact-emr-interconnection**

[16] European Commission (2014), Study of the benefits of a meshed offshore grid in Northern Seas region

[17] See: ECF (2011), Power Perspectives 2030; Booz & Co and Imperial College London (2013), Benefits of an integrated European Energy Market; European Commission (2011), Impact Assessment accompanying the legislative package on the internal market for electricity and gas; Mott McDonald (2013), Impact assessment on European Electricity Balancing Market; Siemens (2013), Competitive energy landscape

[18] See: Imperial College London and E3G (2014), Strategic Development of North Sea Grid Infrastructure to Facilitate Least-Cost Decarbonisation; NSCOGI (2012), Working Group 1 - Grid Configuration; OffshoreGrid (2011), Offshore Electricity Infrastructure in Europe.

[19] European Commission (2014), Study of the benefits of a meshed offshore grid in Northern Seas region http://ec.europa.eu/energy/infrastructure/studies/doc/2014_nsog_report.pdf

regret around investment in the grid is restricted to some €1 billion, even if significant offshore wind fails to materialise (compared to a potential regret of over €30 billion if the current approach is continued).[20]

Industrial Development

In April 2014, French President Francois Hollande called for an 'Airbus' industrial development opportunity for renewables. The development of the North Seas Grid could meet this call. European companies are leaders in the cabling, shipping, generation and transformer industries that will be required. The operation of an integrated grid would also require sophisticated digital technologies to monitor and manage demand across the network. Such 'smart grid' technology is now in demand in other international electricity markets and developing a 'first mover' advantage for Europe would give us the opportunity to create new export markets for European companies.

Technology plays a central role in the development of the North Seas Grid and enabling the creation of a functioning regional market for the free trade of electricity. The size of the potential market strongly impacts the investments into the technology that manufacturing firms would grant: the higher the dimension of the market, the more benefits from economies of scale for R&D investments. The strategy chosen to connect the North Seas countries will impact the focus and investment of developers in providing the enabling technology. It is a virtuous circle that is expected to continuously improve the conditions of both the technology developments and the market.

The development of the offshore grid and wind infrastructure would involve large scale industrial activity and employment in a wide variety of ports and cities on our North Seas coasts which have suffered more than other areas from the long term decline in European shipbuilding and other traditional heavy industries. Over 9 out of every 10 MW of offshore wind installed capacity in 2012 was based in North-West Europe, with UK and Denmark as clear global leaders.[21]

Environmental

If we are to meet our existing commitment to reduce European greenhouse gas emissions by at least 80% by 2050 then we will have to achieve a near 100% decarbonisation of our power system in the same timeframe. Large scale offshore wind deployment in Europe could avoid 315 million tones of CO2 emissions in 2030. This is equivalent to shutting down more than a third of Europe's coal and lignite power plants. The adoption of a 2030 emissions reduction target only makes sense in the context of the longer term transition to a low carbon future. A meshed grid in the North Seas is a key project to risk-manage the delivery of the EU's climate objective since it would reduce CO2 level by 20% compared to current approach.[22] A

[20] Imperial College London and E3G (2014), Strategic Development of North Sea Grid Infrastructure to Facilitate Least-Cost Decarbonisation.

[21] EWEA (2013) The European offshore wind industry - key trends and statistics 2012
https://www.ewea.org/fileadmin/files/library/publications/statistics/European_offshore_statistics_2012.pdf

[22] European Commission (2014), Study of the benefits of a meshed offshore grid in Northern Seas region
http://ec.europa.eu/energy/sites/ener/files/documents/2014_nsog_report.pdf

commitment to the North Seas project will be therefore a clear indication that the Union is progressing on such a path and give us a position of strength in the upcoming international change negotiations.

Public opposition to onshore grid infrastructure is one of the biggest obstacles to the development of our electricity systems. One of the core advantages of a meshed grid is that it would reduce the number of grid lines and transformer stations required to be built in sensitive areas along North Sea coastlines. An integrated grid would reduce the total kilometers of line between 5,500 and 11,100 km needed to connect offshore wind parks and transport electricity across countries. This corresponds to a reduction of 35%-44% in total network length compared to current approach. Germany would benefit the most, saving 39-56 cable corridors to make landfall, followed by the UK with total savings of 4-21.[23] Development of a meshed offshore grid can also serve to reduce the amount of new transmission lines that need to be built onshore as it provides alternative transmission paths. Instead of connecting each wind farm to the closest onshore substation as in the radial case, the high voltage direct current (HVDC) cables could be connected directly at a load centre farther inland through underground cables. It is expected that it is easier to obtain permits for an HVDC underground cable connection than for an overhead line that would be needed to reinforce the grid between the coast and the load centre in the radial case.[24] The development of HVDC cable technology that would come with the project could also help in promoting the undergrounding of other parts of the transmission system.

European Reform

Integrating and strengthening energy markets and renewable energy are key elements of the European reform agenda set out by Cameron, Hollande, Merkel and Juncker. The new €315 billion Jobs, Growth, and Investment Plan proposed by Junker envisages energy infrastructure as a central part of the package, which should focus on "infrastructure, notably broadband and energy networks as well as transport infrastructure in industrial centers; education, research and innovation; and renewable energy".[25] As part of the submission of candidate projects to be included in the Investment Plan, the North Seas countries and the Commission have already proposed 30 offshore grid, 55 offshore wind, and 3 storage projects with a total investment value of at least €90 billion, of which €30 billion are deployable between 2015-2017.[26] Developing the necessary interconnections was also identified by Heads of Government as a key strategic element towards building a secure Energy Union.[27] The development of the North Seas Grid as a regional intergovernmental project is central to deliver the Energy Union in practice, demonstrate that regional collaboration is possible and large scale low cost projects affordable, and support the creation of regional jobs and growth. It promotes a free

[23] Idem, The total savings for the region are 60-102 cable corridors.

[24] Idem

[25] Jean-Claude Junker (2014) A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change **http://ec.europa.eu/about/juncker-commission/docs/pg_en.pdf**

[26] E3G analysis based on project lists submitted by Member States and the Commission. For reference see Special Task Force (Member States, Commission, EIB) on investment in the EU **http://ec.europa.eu/priorities/jobs-growth-investment/plan/docs/special-task-force-report-on-investment-in-the-eu_en.pdf**

[27] European Council (2014) June Council Conclusions **http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/143478.pdf**

market for energy and a regional, rather than centralised, policy approach, which allows priorities to be led by the joint efforts of member states rather than through top-down enforcement.

The project can be a working example of the 'enhanced cooperation' mechanisms provided for under the Lisbon treaty and will restore confidence in the Union's ability to complete large scale transnational infrastructure projects. If successful, the North Sea Grid cooperation model could be replicated elsewhere, notably in the Baltic region, South East Europe and Mediterranean region.

Conclusions

Developing a regional free trade zone for electricity in North-western Europe supported by a North Seas offshore grid is a critical project for the region's energy security, competitiveness, industrial development, and environmental sustainability. The potential benefits are widely recognised by Governments, the Commission, leading industry, national and European politicians, economists, and civil society. Yet the development of this infrastructure is at risk of drift due to a lack of a clear regional strategy reflected by a lack of political leadership and high policy fragmentation.

To realise this potential, a new political mandate is needed, supported by a fresh approach to implementation. Energy Ministers have a key opportunity in 2015, 6 years after the first mandate, to agree to a new strategy to be established, and for investment momentum to be restored.