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An offshore wind union? Diversity and convergence in European offshore wind governance

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Offshore wind megaprojects in European waters have significant carbon abatement potential and increasing their number is a policy goal for several European maritime nations. But experience has shown that governance of large-scale, commercial offshore wind development is not straightforward. It is found that in five EU member states, policy innovation intended to enable investment in offshore wind projects is leading to a convergence upon a distinctive European model of offshore wind governance. The European Union appears to play numerous roles in this process and further research into how offshore wind policy innovation propagates in the EU is warranted.

Policy relevance

The governance of offshore wind megaproject development places specific demands on several areas of policy. This article firstly provides an account of recent developments in how offshore wind governance functions in some of the most important offshore wind-using nations. Secondly, the discussion of the EU's role in shaping offshore wind governance will inform future debates about the proper role of the EU in enabling investment in these megaprojects. Thirdly, the fact that policy appears to be converging raises questions about how policy is transmitted between EU member states, the answers to which could be valuable to policy makers looking at other areas of energy governance. Finally, the observed trend of increasing centralization of decision-making should be of interest to policy makers mindful of the role of scale and decentralization in debates about energy governance.

Keywords: renewable energy; governance; European Union; offshore wind

1. Introduction

It is widely accepted that renewable energy technologies have an important role to play in decarbonizing the energy sector and tackling climate change (IPCC, 2014; IEA, 2015a; Mitchell et al., 2011). In several European countries, the pursuit of offshore wind resources is a stated policy goal, not least due to the apparently wide-open spaces of the sea and the avoidance of some of the problems of acceptance for onshore wind power generation (Ladenburg & Dubgaard, 2007; Twidell & Gaudiosi, 2009).

But, in the same way that Henry Ford's customers could have a car in any colour (as long as it was black), offshore wind projects only come in one size: extra-large; offshore wind turbines are the largest rotating machines in history (Beurskens, 2011). A sector able to deliver the offshore wind megaprojects[1] that have become the norm in Europe (Anzinger & Kostka, 2015; EWEA, 2015) does not happen by accident. Bringing an offshore wind sector into being has involved public policy choices

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in numerous areas including research and innovation, industrial policy, skills, and infrastructure such as ports (BIS, 2013; Fitch-Roy, 2013; Wieczorek et al., 2013). This article focuses on the public policy decisions that directly impact offshore wind project development.

Demonstrating compliance with relevant social and environmental requirements of regulation and law, connecting the plant to the electricity transmission system and ensuring sufficient revenue to raise finance are all vital parts of the project development process. In all European countries seeking exploit their offshore wind resource, development and installation of offshore wind farms is carried out within a framework of wide-ranging pre-existing and targeted legislation and regulations.

The governance[2] of offshore wind project development is distinct from that of other, land-based renewable energy technologies in two important ways. Firstly, the spatial planning implications of the marine environment impact on the legal nature, allocation and complexity of the rights and responsibilities of actors involved (Osherenko, 2007; Young, 2002). Secondly, nearly all elements of offshore wind construction are subject to greater risk and uncertainty that onshore renewables – in part due to the status of scientific evidence of impact and partly due to the relative immaturity of the technology (Leary & Esteban, 2009) – but also the sheer scale of projects and the capital committed to preparing a project for construction. The objective of this article is to demonstrate that the approach taken to the governance of offshore wind development in five EU countries is converging or becoming more similar over time (Kerr, 1983) and to reveal the nature and extent of the convergence.

Since the first commercial offshore wind farm was installed in Denmark in 1992, the policy and regulatory frameworks that govern offshore wind development have evolved in all European offshore wind nations. Until recently, approaches among European member states were diverse with little or no commonality (Wieczorek et al., 2013).

Explanations for this diversity could explore, *inter alia*, the industrial history that shaped the existing institutions, legislation and regulations (Toke, Breuskers, & Wolsink, 2008) or political economic explanations such as varieties of capitalism (e. g. Hall & Soskice, 2001). This article surveys innovation in the governance of offshore wind development in Europe to determine whether it is leading to convergence between member states' approaches over time and role of the European Union (EU) in that convergence. Innovation is defined here as distinct from policy invention and therefore includes approaches or ideas that are new to a particular member state even if they have been implemented before elsewhere (Berry & Berry, 2007; Walker, 1969).

Energy policy making in the EU, perhaps especially renewable energy policy, is conducted simultaneously at the national and European level. Many of the properties of offshore wind, such as its scale and potential role in connecting the transmission systems of nations sharing sea-borders, mean that it is an intrinsically transnational policy area that demands coordination between national approaches (Schillings et al., 2012). At a time when there is a concerted effort within the EU institutions to create a European 'Energy Union' as a powerful integrative force with clear benefits for climate policy (Buzek, 2015), understanding the ways in which energy policy innovations diffuse within the EU is especially important.

In addition to an account of recent developments in offshore wind governance in some of the most important offshore wind nations, this article analyses the nature and extent of convergence between national approaches. It highlights and discusses some of the mechanisms that may drive convergence, including (crucially) the role of EU policy, which in itself is no guarantee of national convergence (Dimitrova & Steunenberg, 2000). The article also comments on the nature of the governance model on which EU offshore wind nations are converging and its coherence with wider trends in climate and energy policy.

2. Approach to analysis

The analysis considers two main areas of offshore wind governance, marine resource management and economic governance. Developing an offshore wind farm has the potential to impact on society and the environment (Bergström et al., 2014; Haggett, 2008; Portman, Duff, Köppel, Reisert, & Higgins, 2009). The legislation and regulations that manage these impacts tend to be complex (Leary & Esteban, 2009; Salter, 2008; Wright, 2014) and the industrialization of the oceans has led to a rethinking of marine governance (see Osherenko, 2007; Salcido, 2008; Wright, 2014). Central to this marine governance is the management and regulation of marine resources such as marine renewable energy including the allocation of seabed tenure and the processes by which development rights are issued.

In addition to marine resource management, there are two areas of economic governance essential for the development of offshore wind farms. First is the question of how wind farms' connections to the onshore electricity transmission system are organized and paid for (Meeus, Lévêque, Azevedo, Saguan, & Glachant, 2012; Meeus, 2014). Second is the nature of the financial settlement available to the project owner.

Four elements of offshore wind governance are used as the basis of this comparison:

(1). The allocation of seabed tenure
(2). The granting of development rights
(3). The responsibility for connection of offshore power plants to onshore transmission
(4). The design of and approach to financial settlement

2.1. Seabed tenure

Models for allocating seabed tenure[3] occupy a spectrum between two opposing extremes:

(1). An 'open-door' approach in which companies promoting an offshore wind project indicate a site[4] where they propose to build an offshore wind farm for consideration by appropriate authorities
(2). A 'defined-site' allocation in which the government or one of its agents identifies a site that is then allocated by the state to a company or companies exclusively for the construction of an offshore wind farm

Between these two extremes is an approach in which state authorities offer an offshore wind 'zone' or zones for the construction of a single wind farm with a degree of freedom over the final location and detailed design. Such rights are often but not always provided in conjunction with 'development rights' described below.

2.2. Development rights

Obtaining permission to develop an offshore wind farm is generally more complex than for onshore renewables (Toke, 2011). Much of this complexity arises from the number of public agencies from which permits must be obtained or to which legal compliance must be demonstrated (Snyder & Kaiser, 2009). The other area of complexity is the requirement to undertake environmental studies and consult with various statutory and other stakeholders as part of the conditions of many offshore permits (Gray, Haggett, & Bell, 2005). Consequently, there are two main ways in which this targeted reform may be implemented: (i) by limiting the number of public agents from which permits must be obtained, and (ii) by limiting the public consultation or the data collection the developer must undertake.

2.3. Grid connection

Meeus (2014) usefully identifies three distinct models for connecting offshore renewable energy projects to the grid (see also Green & Vasilakos, 2011):

(1). A 'transmission system operator (TSO) model' in which responsibility for extending the transmission grid to accommodate offshore connections is performed by the TSO but responsibility to connect to the offshore transmission system remains with the project owner
(2). A 'generator model' in which responsibility to connect to the onshore system lies with the wind farm owner
(3). A 'third party model' in which a (regulated) third party is responsible for the connection between the generator and the onshore system

In European offshore wind nations, electricity consumers ultimately pay for the connection of offshore wind to the transmission system and any required upgrades to the onshore system. Nevertheless, the mechanism by which the costs are recouped is significant. The cost of building and operating a connection to the onshore grid may be recouped through a TSO levy across all its users (generators and consumers) or a direct charge on the connected wind farm. The onshore grid upgrades required may be similarly charged to the developer or 'socialized' across all users.

2.4. Financial settlement

Policy makers have numerous design options available when considering how to support renewable energy investment and there is a copious literature produced over the last two decades discussing the merits of and problems with a wide range of models (see Del Río & Gual, 2004; Fouquet & Johansson, 2008; Mitchell, Bauknecht, & Connor, 2006 etc.). From the perspective of a power generation project developer, there are three elements to a financial settlement[5]. These are:

(1). Access – how is the settlement accessed?
(2). Remuneration model – on what basis is the plant owner remunerated?
(3). Deciding the level – how is the level of the remuneration determined?

Access to the settlement can be either automatic or constrained by budget or volume limits in some way. A financial settlement must specify the basis on which payments will be calculated (Del Río & Gual, 2004; Fouquet & Johansson, 2008; Kitzing, Mitchell, & Morthorst, 2012). The classifications used here are fixed payments per unit of production (e.g. fixed feed-in tariffs), sliding payments to

Table 1 Options for an offshore wind financial settlement

Access	Remuneration model	Deciding the level
Automatic	Fixed	Administratively set
Constrained	Sliding	Specialist market
	Wholesale +	Competitive process

meet a target price (e.g. a contract for difference) and wholesale + : a payment in addition to the wholesale revenue, either from a fixed premium or the sale of a certificate[6] (e.g. the UK Renewables Obligation). The level of the remuneration can be set administratively, through a specialist market ingreen certificates, for example, or by a process in which projects compete directly on the basis of cost to determine the level (Table 1).

2.5. Member state cases

In order to explore the evolution of the governance of large-scale, commercial offshore wind development, a comparative approach is taken. Five EU member state cases are chosen that account for more than 95% of all operating capacity in the EU and in which some policy innovation to allow for future offshore wind construction has taken place as part of a climate change mitigation strategy. The member states chosen are the UK, Germany, the Netherlands, Denmark and Belgium. The table below shows the selection of cases and their offshore wind deployment status (Table 2).

3. Offshore wind in five EU member states

3.1. UK

At the end of 2014, the UK had over 4 GW of operating offshore wind capacity, more than all other EU member states combined (EWEA, 2015).

The British Crown owns nearly all of the UK's territorial water seabed and a statutory corporation known as The Crown Estate holds the portfolio in trust. Outside the 12 nautical mile (nm) limit of the territorial waters, The Crown Estate (TCE) has the rights to license the use of the seabed in the EEZ, which was designated as a 'Renewable Energy Zone' in an order of 2004[7]. TCE corporation acts as seabed 'landlord' and seabed tenure is provided to offshore wind 'tenants' on a commercial basis (The Crown Estate, 2015b). Within areas deemed suitable by the UK's Strategic Environmental Assessment (SEA) (HM Government, 2013), TCE has run four offshore wind leasing 'rounds' to date (The Crown Estate, 2014; Toke, 2011).

The early leasing rounds in 2000 and 2003 were bilateral arrangements between TCE and developers, with developers effectively proposing sites that TCE considered (The Crown Estate, 2015a). In a change of approach and informed by the UK's ongoing Strategic Environmental Assessment (SEA), Round 3 saw zones offered in 2009 to developers by TCE which are 'designed to be large enough to give developers flexibility in the location of wind farms within them' (The Crown Estate, 2013).

Table 2 Offshore wind deployment status in five EU Member States at the end of 2014 (EWEA, 2015)

Member State	Wind farms	Turbines	MW
UK	24	1301	4494
Germany	16	258	1045
Netherlands	5	124	247
Denmark	12	513	1271
Belgium	5	182	712

There are two principal permits required to build marine renewable electricity generating stations in the UK: permission under Section 36 of the Electricity Act (1989) as amended by the 2004 Energy Act[8] and a Marine License issued by the Marine Management Organisation (MMO) in England and Wales and Marine Scotland in Scotland. But, with the inclusion of large offshore wind projects (more than 100 MW capacity) as 'Nationally Significant Infrastructure Projects' in the Planning Act (2008),[9] application has been streamlined into the granting of a single development consent order (DCO) issued by the Energy Secretary. Nevertheless, project developers are still required to conduct several consultation exercises to obtain a DCO (HM Government, 2015).

Although early UK offshore wind farm grid connections were built, owned and operated by the wind farm owner, starting in 2009[10] the UK model for connecting offshore wind farms has been known as the offshore transmission owner (OFTO) regime (Green & Vasilakos, 2011; Meeus, 2014). The OFTO regime sees the rights to ownership of each connection awarded to independent transmission owners through competitive tenders. The early tenders required that the generator offer the connection to auction on completion but the so-called 'enduring regime' allows for both 'generator build' and an 'OFTO build' model. The OFTO recoups its capital by charging the wind farm for access (Ofgem, 2014).

The decision to adopt a third-party model for offshore transmission was taken by the UK Government in 2007 on the grounds that it would enable a more cost-efficient offshore transmission system than an alternative, TSO-led model (DTI, 2007) with plans for the current competitive OFTO system overseen by the market regulator coming later (Ofgem, 2007).

In common with all other large-scale renewable generation technologies, offshore wind in the UK has been supported through a financial mechanism known as the Renewables Obligation (RO). The RO is a variant of the tradable green certificate concept that has undergone significant changes since implementation in 2002, but the basic premise that generators have access to revenues in addition to those from electricity sales remains unchanged (Woodman & Mitchell, 2011). Access to the RO is gained by accreditation of a project by the market regulator and all projects that meet the technical requirement of accreditation have access to the system (Ofgem, 2015).

The main financial support system for large-scale renewables in the UK is in transition from the RO to a new mechanism known as Contracts for Difference (CfD) introduced under the UK Government's Electricity Market Reform (EMR) programme. A CfD is a contract with a Government-owned counterparty that guarantees the holder (generator) payments calculated as the difference between the agreed support level and an index of the wholesale market price for a fixed period, 15 years in the case of offshore wind.

Although the intention was to allocate CfD contracts competitively, the first offshore wind CfDs were awarded in 2014 to five projects with the strike price set administratively to maintain momentum in the pipeline of projects in the period of transition from the RO (DECC, 2014). The transition to competitive allocation of CfDs was completed in February 2015 with two offshore wind projects winning contracts to start operation between 2017 and 2019 in multi-technology auctions administered by the TSO of Great Britain, National Grid Plc (DECC, 2015).

3.2. Germany

Following a relatively slow start to offshore wind development, Germany had more than 1 GW of installed capacity at the end of 2014 with the rate of installation increasing significantly in 2014 and 2015 (EWEA, 2015).

While all issues of land tenure (and permitting) in the territorial waters of Germany are the responsibility of the state governments (Länder), offshore wind activity in the EEZ is overseen by the federal authorities. Prompted in part by the need to manage the social and environmental impact of various uses of the sea (offshore wind in particular), in 2005, Germany's Federal Maritime and Hydrographic Agency (BSH) began work on a Marine Spatial Plan (MSP) for the EEZ. Coming into effect in 2009, the MSP clearly identifies priority areas for offshore wind development (Bundesministerium für Verkehr, 2009, p.19).

Nevertheless, offshore wind developers are entitled, under the Marine Facilities Ordinance, 1997 (Seeanlagenverordnung, SeeAnIV[11]) (Article 5), to submit plans for wind farms in other areas of the EEZ. The BSH takes sole responsibility, under the Marine Facilities Ordinance and in consultation with other competent authorities, for the permitting of offshore wind projects.

Although grid connection was originally the responsibility of the developer, an act was passed in 2006 compelling the relevant TSOs to provide grid connections (Markard & Petersen, 2009). Connection to the transmission grid is provided by the relevant TSO[12], which is obliged under the Erneuerbare-Energien-Gesetz (EEG) or renewable energy law to provide connections at a rate of up to 800 MW per year up to 6.5 GW in 2020 (Lang, 2014).

Germany has had a feed-in system for a range of renewables in place since 1991, originally structured as a supplement to the wholesale power price and replaced by EEG in 2000, which guaranteed a fixed price per unit of production for a fixed period of time (Mitchell et al., 2006) and extended the support to include offshore wind. In 2012[13] the EEG law made provision for 'direct marketing' of electricity from renewable sources that enabled a generator to sell directly into wholesale power markets and receive a 'market premium'[14] calculated as the difference between a measure of the average monthly power price and the relevant tariff. In the 2012 iteration of the law a generator could switch between the tariff and direct marketing on a monthly basis. However, the 2014 EEG introduced 'compulsory direct marketing', which strictly limits the circumstances under which a generator qualifies for the fixed tariff, effectively mandating the direct marketing option.

While the level of remuneration for EEG generators has long been calculated on the basis of energy cost estimates, the compliance with the state-aid guidelines issued by the European Commission in March 2014 (European Commission, 2014) means that member states must implement competitive allocation of financial support by 2017. The relevant German authorities are in the process of developing a renewables auctions system.

3.3. The Netherlands

The Netherlands currently has two operational offshore wind farms installed in 2006 and 2008 with a combined capacity of 228 MW and a legislative act is currently in progress that aims to significantly reform the country's approach to offshore wind (RVO, 2015).

Spatial Planning in Dutch waters is directed by the National Water Plan (NWP) under the Water Management Act (Wet Beheer Rijkswaterstaatswerken, WBR). While in theory the WBR opens up the entire EEZ of the Netherlands to the permitting of wind farms, the available sites were restricted to two areas by the NWP (Government of the Netherlands, 2009). Land tenure and permission to build were combined in a single consent, issued and coordinated by National Water Department for the North Sea (Rijkswaterstaat Noordzee) with significant responsibility on the developer to pursue the appropriate consultations and carry out surveys.

In September 2014 the Government of the Netherlands announced plans to reform their approach to offshore wind in order to promote rapid expansion of offshore wind in the Dutch North Sea (RVO, 2015; Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2014).

In 2015 legislation is expected to pass[15] that significantly alters the approach to seabed tenure and development rights. Tenure will be allocated on the basis of specified wind farm sites located in three designated offshore wind areas. The sites tightly define the wind farm, including location, cable routes and the results of social and environmental surveys sufficient to meet all legal requirements carried out by the Government (RVO, 2015; Loyens & Loeff, 2015; Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2014).

The Dutch TSO, TenneT, has been handed responsibility for building and operating an offshore wind grid with three points of connection to which offshore wind farms can connect. It is not yet clear whether the TSO will charge costs back to the connecting developers or pass them through transmission tariffs (Loyens & Loeff, 2015).

Since 2008, the Netherlands has supported renewable energy via its Stimulering Duurzame Energieproductie (SDE) programme, which included a specific offshore wind tariff allocated by a competitive tender in 2009. Relaunched in 2011 as SDE+, revenues from the policy are structured as a sliding premium tariff in which a generator is provided a level of support per unit production calculated as the difference between the target support level and a measure of the wholesale power price (Jansen, Lensink, Özdemir, van Stralen, & van der Welle, 2011; RVO, 2014)

Following the reforms, licences will be revoked for offshore wind projects that were awarded seabed tenure under a tender in 2009 and seabed tenure, licences to build, grid connection and financial settlement will be awarded to the winner(s) of a competitive bidding process.

3.4. Denmark

Denmark has often been cited as a leader in the deployment of wind energy technology, both onshore and offshore and at the end of 2014 had five offshore wind farms larger than 100 MW in operation accounting for nearly 90% of the 1270 MW of offshore capacity in the country (EWEA, 2015).

The primary approach for Denmark's offshore wind expansion is tenders to build large-scale, commercial wind farms on pre-determined sites. Tenders have been central to the Danish approach to offshore wind since the first call in 2003 (Meyer, 2007; Munksgaard & Morthorst, 2008).

Sites identified through Marine Spatial Planning (MSP) are offered as a package of seabed rights, electricity generation licensing and an offer of a TSO-build and funded grid connection. Applications for are assessed on social and environmental factors before participating in a reverse auction to award the concession to the project bidding the lowest production cost.

The development and deployment of offshore wind in Denmark is overseen by the Danish Energy Agency (DEA). The DEA acts as a single point of contact for nearly all consenting, permitting and licensing activity including the granting of seabed tenure in a so-called 'one-stop-shop' approach. As part of the process of permitting a project, the DEA coordinates communication for necessary consultations between the developer and the various private and stakeholders and governmental bodies (DEA, 2014, 2015a; Government of Denmark, 2008).

Although Danish Electricity Supply Act entitles prospective offshore wind developers to approach the land-tenure and development rights through an 'open door' approach, the financial settlement available to unsolicited offshore projects is the same as that which is available to new onshore projects and therefore unlikely to be adequate to enable commercial investment in megaproject scale offshore wind[16].

The final price per unit of output is provided to the auction winner by the national TSO, Energinet.dk, in the form of a contract for difference for a fixed amount of output, an approach that has been used since 2005 (IEA, 2015c; Kitzing et al., 2012). In all cases, the TSO provides and maintains grid connections as well as taking responsibility for planning and investment in the grid more generally.

3.5. Belgium

Belgium has been actively pursuing offshore wind since 2004 with three large-scale, commercial projects with a combined capacity of over 700 MW operating by the end of 2014 (EWEA, 2015).

In 2004[17], Belgium designated seven offshore wind zones, all of which have now been allocated to developers (Brabant, Degraer, & Rumes, 2011; Loyens & Loeff, 2014). The Federal Public Service (FPS) for Economy reviews prospective wind farm owners' application for rights to occupy the seabed in the Belgian EEZ and advises the Energy Minister, who will then make a decision.

In order to build and operate an offshore wind farm in Belgian waters an Environmental Licence is required from the Minister responsible for the marine environment based on the advice of the Management Unit of the North Sea Mathematical Models (MUMM) under a process that was substantially simplified in 2003 (MUMM, 2010).

All offshore wind project in Belgium to-date have been responsible for their own grid connection, albeit with up to one-third[18] of the capital cost borne by the TSO, Elia (CREG, 2014; Loyens & Loeff, 2014). In 2013 plans were announced to begin the so-called Belgian Offshore Grid (BOG), a TSO funded initiative to provide 'socket-at-sea' connections to future offshore wind farms (CREG, 2014; Elia, 2013, 2015). Completion of the project was originally expected to occur by 2018 and works to strengthen the onshore grid began in spring 2015. Although managed by the TSO, the connection costs are expected to be charged on to the wind-farm developers.

Regions of Belgium began implementing TGC policies in 2002 (Verbruggen, 2004) with the legal basis for offshore wind projects to sell certificates at a guaranteed minimum price in place from 2003 (Loyens & Loeff, 2014; IEA, 2015b; 3E, 2013). The minimum price effectively structures the remuneration as a fixed premium to a project's wholesale revenues.

For projects reaching financial close after May 1, 2014 the revenue structure has changed. The new system calculates the minimum certificate price as the difference between an average of the wholesale market price[19] and the target minimum price (initially EU€138) set by Royal decree. In common with all other EU members, Belgium can be expected to begin competitive allocation of offshore wind support by 2017 as required by the European Commission's state-aid guidelines of 2014.

4. Results and summary

4.1. Results

4.1.1. Seabed tenure

Open door approaches to seabed tenure were the starting point in most cases but almost all countries have altered the way tenure is allocated. From four out of five offering tenure on an open door basis to the same proportion offering defined-sites or zones. Only Germany continues to allocate offshore wind seabed tenure on an open door basis (Table 3).

4.1.2. Development rights

All countries have implemented reforms to the development rights process. The reforms have all been quite different in approach. While some seek to relieve the developer of the burden of public consultation or costly studies, others are based on the one-stop-shop principle of limiting the number of points of contact between a developer and public bodies. Nevertheless, all countries have implemented changes that increase the degree of centralization in decision-making about offshore wind development rights (Table 4).

4.1.3. Grid connection

Other than the UK, which has a unique third-party model, all countries have moved to – or are in the process of moving to – a TSO model for connecting offshore wind farms to onshore transmission systems. There is some diversity within the countries taking the TSO-led approach, with Denmark and Germany recovering the connection cost through a levy on network users or consumers, while Belgium and possibly the Netherlands intend to recover the cost directly from the wind farm(s) to be connected. The UK model does not allow for generalized recovery of connection costs (Table 5).

Table 3 Summary of approaches to seabed tenure

	Open door	Zoned Tender	Single site tender
UK	2000–2009	2009-	
DE	1997-		
DK	1991–2004		2004-
BE		2004-	
NL	2001–2015		2015-

Table 4 Summary of approaches to development rights[21]

	Changes resulting in more centralized development rights process
UK	Decision by minister since 2008
DE	Decision by BSH since 1997
DK	All major permitting work undertaken by DEA since 2004
BE	EIA carried out by MUMM since 2003
NL	All permits administered by MEA since 2015

4.1.4. Financial settlement

Some form of constrained allocation of support for offshore wind has been implemented in most of the cases. Although Germany and Belgium have not formally begun implementation of a constrained allocation system, the European Commission's State Aid guidelines of 2014 suggest that such a system should be in place by 2017. Since 2008, all of the member state cases have implemented some form of sliding premium mechanism. The means by which the level of remuneration of offshore wind generation is set is in most cases some kind of competitive process, with Germany and Belgium likely to follow suit by 2017(Tables 6–8).

Table 5 Summary of approaches to grid connection

	Developer model	Third-party model	TSO model	Cost recovery mechanism
UK	2000–2007	2007-		OFTO charges wind farm
DE			2006-	TSO levy
DK			2004-	TSO levy
BE	2004-		*2018*	TSO charges wind farm
NL	2006-		*2016*	Unclear

Table 6 Summary of approaches to financial settlement allocation

	Automatic	Constrained
UK	2002–2015	2015
DE	...	2017
DK		2003
BE	...	2017
NL		2009

Table 7 Summary of approaches to financial settlement structure

	Fixed	Sliding premium	Wholesale +
UK		2014-	2002–2014
DE	2000–2014	2014-	1991–2000
DK	1993–1999	2005-	1999–2005
BE	2002–2015	2015-	
NL		2008-	

Table 8 Summary of approaches to setting the level of the financial settlement

	Administrative process	Certificate market	Competitive process
UK	2014–2015	2002–2014	2015-
DE	2000-		2017
DK	1993–2003		2003
BE	2002-		2017
NL			2009-

4.2. Summary

There has been significant policy innovation leading in the governance models for offshore wind development in all five cases chosen. There is also some degree of convergence across all four of the elements of offshore wind governance (Table 9).

While not all cases have arrived on an identical model, a broadly 'European' model can be observed based on:

Table 9 Summary of national approaches

	Seabed Tenure	Development rights	Grid connection	Financial settlement
UK	Zoned	Centralized but onus on developer	OFTO	Constrained allocation of sliding premium revenue support
DE	Open door	Centralized and streamlined	TSO and levy	
DK	Single site	Centralized	TSO and levy	
BE	Zoned	Centralized	TSO charges wind farm	
NL	Single site	Centralized	TSO	

(1). designated-site or zoned seabed tenure model
(2). targeted reform of how development rights are issued (generally in the form of more centralised authority)
(3). TSO-led, -built or -funded grid connection
(4). constrained allocation of sliding premium revenue support

Notable deviations from this model are the UK's unique third-party ownership model for connecting offshore wind farms to the grid and Germany's open door approach to seabed tenure.

5. Conclusion

The innovation in offshore wind governance described here is characterized by the participation of EU, national and subnational actors. Questions are raised about why the five countries analysed appear to be moving towards similar governance arrangements. There is evidence suggesting that policy diffusion between member states – via the EU or directly between member states – is at least partly responsible for the convergence. The similarity of member states' policy making conditions appears to be less important.

One might expect policy diffusion within the EU, the very existence of which is an attempt at policy harmonization between countries (Bomberg & Peterson, 2000; Padgett, 2003; Radaelli, 2000) but the role of EU policy varies between the four aspects of governance. In some cases the influence of the EU appears to be direct. The European Commission guidelines on State Aid require that instruments such as 'auctioning or competitive bidding process(es)' are used as the primary support system for renewables (European Commission, 2014, p.31). The guidelines undoubtedly have significant implications for the future financial settlement for renewables across Europe. But this explanation does nothing to account for the fact that countries such as Denmark, the Netherlands and possibly the UK began implementing policies to reform the way in which financial settlements for offshore wind were allocated and their level set more than a decade before the EU's guidelines were published. One could hypothesize that one or more of these earlier innovators successfully 'uploaded' their policy preferences to the EU level, which were subsequently 'downloaded' to the other member states (Padgett, 2003). More research could discover the nature and extent of influence.

Another area of economic governance in which the EU plays a coordination role is the regulation of electricity networks. There has been innovation in the way offshore wind farms are connected to the onshore transmission system and in all five cases a 'generator model' connection has been abandoned in favour of two alternative models, possibly due to the requirements of the EU's third electricity liberalization package (Green & Vasilakos, 2011). But while the EU's attempts to encourage electricity liberalization may play a role in defining national approaches to offshore grid connection generally (European Commission, 2008), an interpretation of the unbundling requirements that negates the generator model is not universally accepted[20]. Also, the cost and returns to scale for offshore wind grid connections that can account for up to 20% of a project's capital expense create a powerful functional argument at the member state level for TSO models (European Commission, 2008; BVG, 2010) with the UK's third-party approach an interesting exception.

The effect of EU policy on the granting of offshore wind development rights is less direct. The 'maze' (Wright, 2014) of organizations and laws that must be negotiated was, until recently, almost entirely different in each of the five countries. Some relied on legislation aimed at the electricity sector and others on nature conservation law, much of which derived from the EU's Habitat's and Birds Directives (Fox, Desholm, Kahlert, & Christensen, 2006) – an example of an EU policy with a history of patchy policy convergence (Beunen & Duineveld, 2010). Nevertheless, all five countries have looked to greater centralization of decision-making authority and/or reducing the number of stakeholder voices with access to the process.

The EU-supported move to auctions as the primary means of allocating and setting the level of remuneration for offshore wind is likely to have secondary effects including greater centralization of offshore wind governance. The timing and sequencing of the planning process has been shown to be of greater importance for the smooth functioning of auction systems than for other financial policies (Del Río & Linares, 2014). The implication is that auction processes demand greater coordination between seabed tenure, the development rights process, grid connection and financial settlement. A reasonable expectation might be that greater coordination precipitates an increased role for central government agencies to manage the interactions. While Denmark and the Netherlands have implemented or announced a fully integrated auction system with all four elements managed within a single process, the other countries have only recently implemented an auction system or will do in the next two years.

There are clear examples of national offshore wind policy makers working to exchange policy ideas directly. For example, through networking events explicitly designed for the European offshore wind policy making community to meet and share experiences and know-how, led by the Government of Denmark but without representation of the EU institutions (DEA, 2015b). As well as direct social interaction, peer-to-peer diffusion may also result in emulation of apparently successful policies implemented elsewhere.

Similar economic, institutional or legal conditions do not appear to predict the closeness or otherwise of two member states' offshore wind governance particularly well. The UK, the most classically liberal market economy (LME) in the group (Hall & Soskice, 2001), is not especially market-oriented in its financial settlement, innovating to make a market solution (i.e. auctions of sliding tariffs) central to its approach to offshore wind around the same time as Germany and well after Denmark and the Netherlands, all of which better fit the description of coordinated market economy (CME). The UK's unique third-party approach to grid connection might, however, better suit the expectation of an LME.

Innovation in offshore wind seabed tenure has tended to reduce the breadth of options open to potential developers. The approaches appear to be largely independent of the legal and institutional basis on which seabed tenure is let. For example, the UK, with its landlord approach for seabed tenure, has developed a zoned-tenure model – as has Belgium, a federal state with no parallel institution to The Crown Estate. The influence of EU policy is also muted with very little apparent impact. It may be the case that Belgium and Netherlands observed and emulated the success of the UK and/or Denmark, which implemented zoned and single-site tenure some time ago.

Offshore wind energy has the potential to play a significant role in the decarbonization of the European economy and help tackle climate change. Approaches to the governance of offshore wind development in Europe are converging on a common model with the EU so far playing a number of roles alongside other processes. Universal implementation auctioning of offshore wind financial settlements may place incentives on national policy-makers to further centralize decision-making about offshore wind in order to enable effective auctions to take place. This centralization, combined with the megaproject scale of offshore wind projects puts it at odds with much of the discourse about the role of scale and decentralization in efforts to tackle climate change and the transition to a low-carbon energy system (Wiersma & Devine-Wright, 2014). For this reason alone the wider political and social dimensions of offshore wind are deserving of much greater attention.

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Notes

1. Flyvbierg (2014) provides a useful definition of mega project as '*large-scale, complex ventures that typically cost US$1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people*'.
2. Defined here as the policies and regulations that govern the interaction between offshore wind project developers and the various national, local and non-governmental bodies involved in establishing a large-scale, commercial offshore wind farm.
3. Although 'tenure' might not strictly be issued more the 12 nautical miles from a nation's sea coast, where the bulk of offshore wind megaprojects are built, the rights to allow occupation of the seabed in the exclusive economic zone (EEZ) reside with the nation's government under the UN Convention on the Law of the Sea (1982).

4. With potential inappropriate sites and areas excluded in a process of Marine Spatial Planning (MSP)
5. Settlement defined here as the access to and structure of revenue from targeted policy intervention – including any support mechanism.
6. The value of which is not a function of the wholesale electricity price (Couture & Gagnon, 2010).
7. (*Electricity: The Renewable Energy Zone (Designation of Area) Order 2004*).
8. UK Energy Act (2004) Pt 2 Chapter 2.
9. UK Planning Act (2008) s15(3)(b).
10. With first connections in 2011.
11. (*Ordinance on Offshore Installations Seaward of the Limit of the German Territorial Sea (Offshore Installations Ordinance)*).
12. The coastal regions of Germany are covered by two TSOs, TenneT (owned by the Dutch government) in the North Sea and 50 hz (partly owned by the Belgian government) in the Baltic Sea.
13. Chapter 2. Germany. Act on granting priority to renewable energy sources (Renewable Energy Sources Act – EEG). (2012).
14. Generators also receive a supplement to compensate for the cost and risk of direct power market participation.
15. Offshore wind act submitted to parliament October 16, 2014.
16. Although not inconceivable – a number of projects are in the early stages of progressing through the open-door system.
17. Although the first concession was let in 2003 (Brabant et al., 2011).
18. Up to €25m
19. 90% of the price at the APX electricity exchange.
20. Sweden, for instance, maintains a 'generator' model for connecting offshore wind farms (SKM, 2012).
21. Expected or upcoming changes in *italics*.

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