DECC - Research into GB offshore electricity transmission development. A comparative assessment with key countries.

FINAL REPORT

- V.1.1
- 14 February 2012

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1. List of Abbreviations

AC	Alternating Current
ARRA	American Reinvestment and Recovery Act of 2009
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BSH	Federal Maritime and Hydrographic Agency
CER	Commission for Energy Regulation
COP	Construction and Operation Plan
CRE	Commission de régulation de l'énergie
CREG	Commission for Electricity and Gas Regulation
CREIA	Chinese Renewable Energy Industries Association
CNOOC	China National Offshore Oil Corporation
DEA	Danish Energy Agency
DECC	Department of Energy and Climate change
DEFRA	Department for Environment, Food and Rural Affairs
DENA	Deutsche Energie-Agentur GmbH
DNR	National Water Department for the North Sea
DOE	Department of Energy
DOI	Department of the Interior
DSO	Distribution System Operator
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ENSG	Electricity Networks Strategy Group
ENTSO-E	European Network of Transmission System Operators for Electricity
ERCOT	Electric Reliability Council of Texas
ERO	Electric Reliability Organisation
ESB	Electricity Supply Board
FERC	Federal Energy Regulation Commission
FRCC	Florida Reliability Coordinating Council
FSL	Final Sums Liabilities
GB	Great Britain
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IGUCM	Interim Generic User Commitment Methodology
IPC	Infrastructure Planning Commission
ISO	Independent System Operator
MEC	Maximum Export Capacity
MITS	Main Interconnected Transmission System
MO	Market Operator

MRO	Midwest Reliability Organization
NEB	National Energy Board
NEEZ	Dutch Exclusive Economic Zone
NETSO	National Electricity Transmission System Operator
NERC	North American Reliability Corporation
NGET	National Grid Electricity Transmission
NMa	Netherlands Competition Authority
NPCC	Northeast Power Coordinating Council
NREAP	National Renewable Energy Action Plan
NWP	National Water Plan
O&M	Operation and Maintenance
OCS	Outer Continental Shelf
ODIS	Offshore Development Information Statement
Ofgem	Office of the Gas and Electricity Markets
OFTO	Offshore Transmission Owner
OSWInD	Offshore Wind Innovation and Demonstration
OTCP	Offshore Transmission Coordination Project
OWF	Offshore Wind Farm
PSO	Public Service Obligation
PTF	Proposition technique et financière
REZ	Renewable Energy Zone
RFC	Reliability First Corporation
RTC	Regional Transmission Companies
RTE	Réseau de transport d’électricité
RTO	Regional Transmission Organisations
SAP	Site Assessment Plan
SDE	Stimulation of Sustainable Energy Production
SEA	China's State Energy Administration
SEM	Single Electricity Market
SEMO	Single Electricity Market Operator
SERC	SERC Reliability Corporation
SHETL	Scottish Hydro-Electric Transmission Limited
SOA	State Oceanic Administration
SPP RE	Southwest Power Pool Regional Entity
SPTL	Scottish Power Transmission Limited
SvK	Svenska Kraftnät
TNUoS	Transmission Network Use of System (tariff)
TAO	Transmission Asset Owner
TCE	The Crown Estate

TOCO	Transmission Owner Construction Offer
TII	Transmission Investment Incentives
TRE	Texas Reliability Entity
TSO	Transmission System Operator
TYNDP	Ten Years Network Development Plan
WECC	Western Electricity Coordinating Council

2. Definitions

Coordination	From DECC's tender specification for this project: "Coordination' is taken to mean the sharing and future-proofing, where suitable, of electricity transmission assets back to shore within or between different Crown Estate Round 3 wind farm development zones. It might also involve using such assets for the additional purpose of interconnection between countries. Sharing or future-proofing of assets would be suitable where it led to a more effective or efficient means of meeting DECC decarbonisation and security of supply objectives. This might be the case where coordination resulted in less infrastructure being required, which could reduce costs or planning delays"
Generator	(throughout this report) offshore wind farm developer
Offshore transmission system	A system consisting (wholly or mainly) of the high voltage electric line(s) used for the transmission of electricity between the offshore and onshore substation(s). Hence an offshore transmission system extends from the onshore connection point(s) to the offshore connection point(s). Note that point-to-point connection is also covered under this definition.
National Electricity Transmission System	The system consisting (wholly or mainly) of the high voltage electric line(s) used for the transmission of electricity between substations, power stations, offshore transmission systems or any international interconnections.
Offshore transmission assets	Any hardware, such as plant and apparatus or meters, that constitute the offshore transmission system
Anticipatory Investment	Anticipatory investment would allow the transmission system owners to invest in new transmission infrastructure, before the need is established through firm commitments of new generation to connect and pay TNUoS charges. Under such arrangements, transmission network companies could make speculative investments in network reinforcements to accommodate growth in renewable generation

Oversizing	Investment in transmission capacity greater than established through firm commitments of new generation to connect and pay TNUoS charges.
Interconnection	AC or DC connection between any two substations
International interconnection	AC or DC connection between the transmission systems of two countries.
Current offshore generation projects	Offshore generation projects that have been completed and are fully operational as of July 2011
Under construction projects	Offshore generation projects that are under construction as of July 2011
Approved projects	Offshore generation projects that have obtained all approval and consents required for the project but have not yet begun any construction works as of July 2011
Planned projects	Offshore generation projects that have only submitted application for consent or approvals as of July 2011
Point-to-point connection	A system with a single simultaneous path of power flow from a single generating plant to the load.
Collective connection	A system with a single simultaneous path of power flow from several generating plants to the load.
National Transmission System Operator (TSO)	Entity entrusted to manage the security of the national transmission system in real time and co-ordinate the supply of and demand for electricity, in a manner that avoids fluctuations in frequency or interruptions of supply.
Shallow connection charges	These are usually based on simply recovering the costs related to the physical connection of assets between the connecting party and (usually) the nearest network connection point.
Deep connection charges	These are based on a combination of shallow charges plus the costs related to any additional wider (“downstream”) network reinforcement, required to support the load/generation of the connecting party.

Offshore connection point	The point at which the OWF connects to the offshore transmission system. This is the low or medium voltage busbar on the offshore substation platform.
Onshore connection point	The electrical point of connection between an offshore transmission system and an onshore transmission system,
Locational zonal transmission network use of system (TNUoS) tariffs	Charges for use of the transmission network for power injections or withdrawals that differentiated locationally as a function of share of either current or long-run costs related to power injections or withdrawals in different zones.
Locational nodal transmission network use of system (TNUoS) tariffs	Charges for use of the transmission network for power injections or withdrawals that differentiated as a function of share of either current or long-run costs related to power injections or withdrawals at different nodes.
Gate	In Ireland, a round for submission of connection applications that will be processed, by the TSO/DSO (EirGrid/ESB Networks) under the Group Processing Approach.
Group Processing Approach	In Ireland, processing of connection applications in batches to allow for minimisation of combined transmission infrastructure required, i.e. where deemed more economically efficient joint connection offers will be made.

3. Introduction

The Government has set an ambitious target for the deployment of renewable energy over the next decade. By 2020, the Government expects that 15 percent of the United Kingdom's (UK) energy needs will be met from renewable sources and suggests around 30 percent of electricity may come from renewables. Offshore wind will play an important part in meeting these renewable energy targets.

The adoption of offshore wind generation has numerous advantages but one of the fundamental issues is the cost of offshore wind farms (OWF) and associated offshore transmission assets.

In addition to existing plans and extensions from Rounds 1 and 2, The Crown Estate (TCE) has tendered the development rights for up to 32,000MW of offshore wind generation under Round 3. In total, there is almost 50,000MW of capacity that is either subject to an agreement to lease (including Scottish Territorial Waters) or has already been leased. To facilitate the expansion of offshore wind, the UK Government has introduced a regulatory regime for offshore electricity transmission which effectively separates the offshore generation from the offshore transmission. Offshore transmission is a licensed activity, regulated by Ofgem (Office of the Gas and Electricity Markets), with the Offshore Transmission Owner (OFTO) licence awarded through a competitive tender process to encourage new participants and funding into the regime. The regime came into effect in June 2010 with a transition process taking place from June 2009.

Government and Ofgem have consulted extensively on refining the regulatory regime and competitive tender process. The response to the joint further consultation on the enduring offshore electricity transmission regime in August 2010[1] indicated that while the competitive offshore electricity transmission regulatory regime creates no barriers to coordination, the current incentives may not be sufficient to bring about significant levels of coordination in practice. The Department of Energy and Climate change (DECC) and Ofgem are currently undertaking an Offshore Transmission Coordination Project (OTCP) to consider whether additional measures are required within the competitive offshore electricity transmission regulatory regime to further maximise the opportunities for coordination.

It is within the context of this project that DECC engaged SKM and sub-consultant CEPA to conduct a comparative analysis of offshore electricity transmission regulatory regimes in key

[1] Further consultation on the enduring offshore electricity transmission regime in August 2010 consultation included questions on the proposals for allowing a generator build option, a further opportunity to comment on the detail of the early and late OFTO appointment options, and requests to present views on whether any further actions were necessary within the offshore electricity transmission regulatory regime to facilitate the development of a coordinated onshore and offshore transmission system.

countries with significant amounts of existing (and/or planned) offshore wind generation (Great Britain (GB), Germany, Denmark, Netherlands, Ireland, France, Belgium, Sweden, USA, China) and articulate lessons learned from other relevant infrastructure sectors. The results of the project are covered in three deliverable reports:

Deliverable 1: A comparative assessment of the GB offshore electricity transmission regulatory regime with the regimes of other key countries.

Deliverable 2: An assessment of key lessons learnt from how other countries deal with coordinated electricity transmission development between the offshore developers.

Deliverable 3: Assessment of key lessons learned (which are relevant for the development of GB offshore electricity transmission systems) from how comparable infrastructure in other relevant sectors, such as oil, gas, and CCS pipelines in the UK and other countries, deal with coordinated infrastructure development between different developers.

This report provides a comparative assessment of the offshore electricity transmission regulatory regimes in the key countries. The report is structured starting with a presentation of the methodology, followed by a short overview of the offshore electricity transmission regulatory regime in each country. The countries are then grouped, based on the development stages of the offshore electricity transmission regulatory regimes, and more detailed information from the comparative analysis is provided for each group. This is followed by observations and conclusions from the comparison. Detailed overviews of the regulatory regime in each country are provided in Appendix A.

4. Methodology

The key objective for this part of the project is to conduct a comparative analysis of the current and proposed offshore electricity transmission regulatory regimes in 10 countries. The assessment will enable DECC to compare and contrast GB's current offshore electricity transmission regulatory regime with that of other countries. DECC has outlined a comprehensive list of key aspects to be addressed:

i. what are the **current status** and **future plans** for offshore wind power;

ii. how are transmission assets **classified**;

iii. is there/will there be an **offshore grid overall design** (including level of detail, whether it includes interconnection, the status and who produces and updates it);

iv. who can/does/will **construct** offshore transmission system;

v. is there/will there be any **standardisation** of transmission assets or control systems, and if so in what respects and by whom;

vi. who can/does **operate and maintain** the infrastructure once built;

vii. for transmission assets that are likely to be shared between different projects/developers, how does/will the **consenting process** work;

viii. how does/will the grid **connection process** work;

ix. can/does any **preconstruction works** take place to help ensure future-proofing;

x. can/does any **oversizing** of initial assets take place to help ensure future-proofing;

xi. details of the **user commitment/financial security** rules for the construction of new transmission infrastructure;

xii. the extent to which **anticipatory investment** can/does occur, who bears the risk of any stranding of assets and to what extent;

xiii. where transmission assets are not built by the generator, the **track record for arriving in time** for the first export of power; and

xiv. details of the offshore **transmission charging** system, including the costs borne by the offshore generator and how it deals with shared offshore transmission assets.

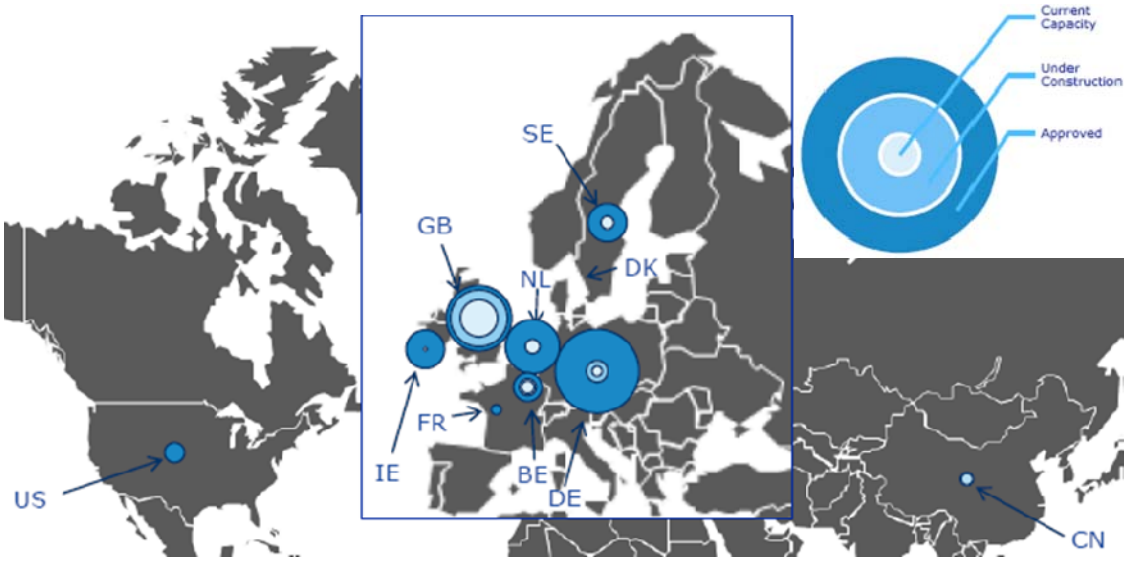
In order to assist comparison of the offshore electricity transmission regulatory regimes, a high level matrix was created covering the above key issues. The matrix allows easy comparison between the countries. The topics in the matrix were agreed with DECC and populated with information obtained from the review of documents and studies available in the public domain addressing offshore wind development plans and current offshore electricity transmission regulatory regimes for the ten countries identified. To ensure that all aspects of offshore electricity regulatory regime in each country were fully covered and information available in public domain was not misinterpreted, the regulators in all key European countries were given an opportunity to review and comment on their country overview (see Appendix A) and respective entries in the matrix. Response were received from the UK, Belgium, Netherlands, France, Denmark, Sweden and Germany. All received comments were incorporated in this report and the matrix.

For the countries where development plans are more embryonic, the future plans for offshore transmission systems and proposals for the corresponding regulatory framework for offshore electricity transmission were reviewed.

5. Country by country overview

This section presents a brief overview of the offshore electricity transmission regulatory regime in each key country (if any). A detailed overview is provided in Appendix A.

The current and future status of offshore wind power developments in the studied countries are shown in Figure 1. In the figure, "current" capacity refers to operational projects, "approved" refers to OWFs that already hold site consent and "planned" to those that have applied for site consent. Table 1 provide details on the offshore wind capacities of each country[2]. Additionally the table specifies the offshore wind capacities that are envisaged by 2020 for each country, based on potential offshore zones/sites identified for OWF development. The National Renewable Energy Action Plan (NREAP) published by the European Commission (based on submissions from Member States) also provides the offshore wind capacity expected by 2020[3]; these are included in Table 1. For reference, national renewable energy targets are also shown in the table.



■ **Figure 1 Offshore wind capacity**

[2] Global OWF data base at Uwww.4coffshore.comU. The information is correct as of July 2011. Also note since information is from the same data base it is assumed that same project status definitions apply for all countries.
3 European Commission NREAP, Uhttp://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htmU

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■ **Table 1 Offshore wind power development status in the key countries**

Category \ Country	GB	DE	DK	NL	IE	US	FR	SE	BE	CN
Current Offshore Generation, MW	1,525	120	868	247	25	0	0	130	195	144[4]
Under construction, MW	2,050	400	400	0	0	0	0	0	148	51
Approved, MW	1627	7,235	0	2991	1,595	468	108	1,075	529	0
Planned (Consent application submitted), MW	1960	10,566	600	719	1,794	3,269	1,455	2,034	N/A	402
Offshore wind potential[5] by 2020, MW	18,000[6]	No specific target[7]	No specific target	No specific target	No specific target[8]	10,000	6,000	No specific target	2,000	30,000
NREAP targets, MW[9]	12,990	10,000	1,339	5,200	555	N/A	6,000	2,914	0	N/A
Renewable targets (% of total energy consumption by 2020)	15%	18%	33%[10]	14%	16%	No national targets[11]	23%	49%	13%	15%

From Table 1 it is evident that the stages of OWF development are quite different in each of the studied countries. For example in Netherlands, Ireland and Sweden there are a lot of approved and planned projects but nothing is actually under construction at the moment. While the regulatory regime for offshore electricity transmission is one of the factors influencing offshore wind power development, there are other significant contributing aspects, e.g. political support, incentives, certainty in the current regime, specified timelines for project development stages, consenting and tendering, bank lending policies etc. Appendix B seeks to provide an indication of the possible

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[4] In China there are also two near shore (<1km) projects, 201MW and 100MW.
[5] This is based on zones/sites chosen on national level as suitable of OWF development and either already leased out for OWF development or planned to be leased out in the upcoming tender rounds.
[6] Central scenario in UK Renewable Energy Roadmap, published by the Office of Renewable Energy Deployment (ORED), DECC, in July 2011. This scenario assumes offshore wind cost reductions.
[7] Although there are no official governmental targets the offshore wind installed capacity in Germany is expected to be 10,000MW by 2020
[8] 600MW foreseen to be installed
[9] NREAP available at: Uhttp://ec.europa.eu/energy/renewables/transparency_platform/action_plan_en.htmU
[10] Originally 30% but the new energy strategy report (Uhttp://www.denmark.dk/NR/rdonlyres/2BD031EC-AD41-4564-B146-5549B273CC02/0/EnergyStrategy2050web.pdfU) has increased the target by 3%
[11] Renewable targets are defined on state level in the USA, currently 29 states have renewable energy targets.

causes for the current statuses of offshore wind development in each country. The reasoning is based on the findings of this project and other studies available in the public domain.

As part of the overview for each country, Table 2 below provides information regarding the transmission system operators (TSOs) and transmission asset owners (TAO) for the studied countries.

- **Table 2 Transmission system operators (TSOs) and transmission asset owners (TAOs) in the key countries[12]**

	GB	DE	DK	NL	IE	FR	SE	BE
TSO[14]	NGET	TenneT, 50Hertz [13]	Energinet	TenneT	EirGrid	RTE	SvK	Elia
TAO[14]	NGET, SPTL, SHETL, OFTOs[15],	TenneT, 50Hertz[13]	Energinet	TenenT	ESB Networks	RTE	SvK	Elia
Who owns TSO	Plc	TenneT – Dutch government, 50 Hertz – Elia	State	State	State	Subsidiary of the partially public-owned Électricité de France (EdF),	State	Mixed[16]
Who owns TAO	See above	See above	See above	See above	Semi-state	See above	See above	See above

5.1. Great Britain

At present, GB is the leading country in terms of offshore wind power development with 1,525MW currently in operation and 2,050MW under construction. This is believed to be due to one of the most favourable environments for investment[17].

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[12] List of abbreviations is available in Section 1

[13] There are two more TSOs in Germany but those are not relevant for offshore wind farm development (no access to the cost)

[14] For international interconnectors various arrangements apply regarding ownership and operation. See Deliverable 3 report for more information on some HVDC international interconnectors.

[15] The ownership of transmission assets in the UK falls on NGET in England and Wales, SPTL in Southern Scotland, SHETL in northern Scotland and the OFTOs for offshore assets.

[16] 52.1% of Elia's shares are freely floated on Euronext, 45.37% is owned by Publi-T SCRL, a cooperative company representing Belgian municipalities and inter-municipal companies, and 2.53% by Publipart, a holding company of SPE.

[17] According to Ernst & Young attractiveness index (August 2011) for offshore wind in Germany and UK is the highest and at the same level for both countries.

The seabed, within the UK Territorial Waters, and the rights to exploit resources throughout the UK Exclusive Economic Zone (EEZ) are controlled by TCE. TCE has invited bids for leasing the seabed to OWF developers via a series of tendering rounds[18].

In addition to existing plans and extensions from Rounds 1 and 2, TCE has tendered the development rights for up to 32,000MW of offshore wind generation under Round 3. In total, there is almost 50,000MW of capacity that is either subject to an agreement to lease (including Scottish Territorial Waters) or has already been leased. In Round 3, nine offshore development zones were identified. Each zone will be developed by TCE and a partner consortium. One consortium for each offshore wind development zone was selected through a competitive tender process. The consortia will work with TCE to identify suitable OWF sites within each zone and thereafter focus on addressing delivery of specific sites. TCE will co-invest (up to 50% of pre-consent development costs) with the contracted consortia in the development programme up to the point of achieving consent for the OWFs, after which the involvement of TCE will end, leaving the zone developer to manage construction and operational activities.

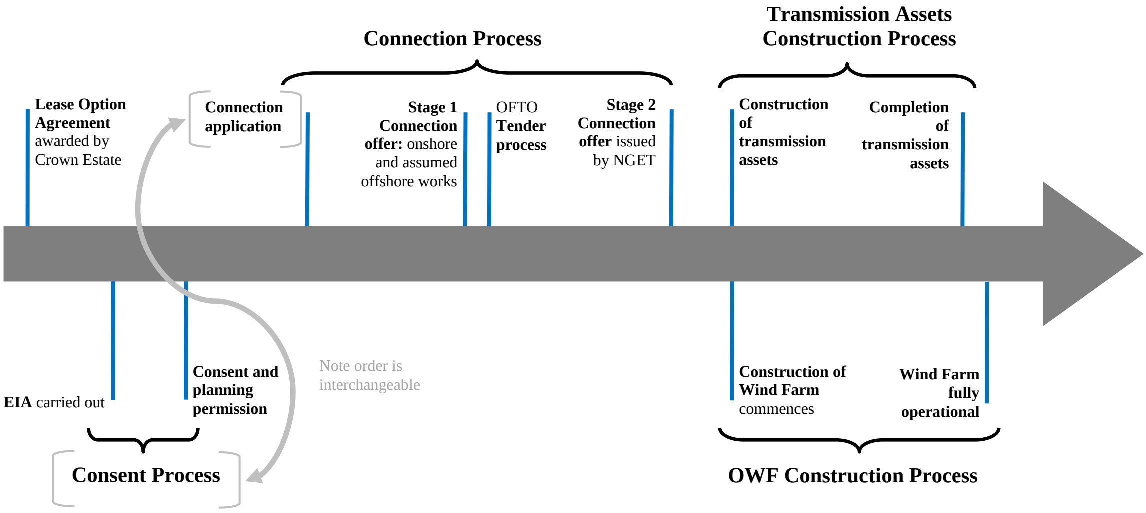


Figure 2 OWF development process in the GB

The UK Government introduced a new offshore electricity transmission regulatory regime that effectively separates the offshore generation from the offshore transmission. Offshore transmission is a licensed activity regulated by Ofgem and qualifying companies bid, through a competitive tender process, to become the OFTO for a particular offshore transmission system. The OFTOs will receive, via NGET (National Grid Electricity Transmission), acting in its role as TSO, the 20 year revenue stream payments determined by its bid during the tender process, which is based on the cost submissions for financing, designing/constructing (if applicable), operating, maintaining and

[18] Information on GB rounds and projects can be found on The Crown Estate website Uhttp://www.thecrownestate.co.uk/U

decommissioning of the transmission assets. NGET will calculate and levy the charges payable by the offshore generator for the transmission service, known as the transmission network use of system (TNUoS) charges[19]. The OFTO will be required to demonstrate compliance with certain licence conditions throughout the period in which their licence is in force, in particular relating to availability performance. The regime came in to effect on June 2010 with a transition process (i.e. a period to allow developers with existing offshore projects to adapt to the new connection arrangements) taking place from June 2009.

Under the enduring regime the generators will be able to choose to construct the transmission assets for the project or to opt for the OFTO to do so. In the latter case, “early” OFTO appointment is possible where the OFTO will become responsible for the planning, design, consenting, construction and operation of the transmission assets. Alternatively “late” OFTO appointment is possible once all the necessary consents are secured.

5.2. Germany

German OWFs require high investment costs due to longer distance to shore and greater water depths at suitable locations. There are currently only two OWFs operational in Germany with total installed capacity of 120MW. However there is approximately 400MW under construction and a further 7,235MW with consents in place[17]. The large number of projects that are past the consenting stage (i.e. approved) may be attributed to the number of earlier projects that have finally completed the lengthy consenting process (3.3 years on average[20]). Grid connection issues and the responsibility for building an offshore transmission system(s) has long been an open debate and the current arrangements, detailed below, will only be in force for a limited period of time. Moreover, from 2015, there will be a regression of 5% per annum on the combined feed-in tariffs and bonuses for new projects going online[22]. The rush to meet these deadlines may also offer an explanation for the large number of approved and planned projects in the pipeline. For a number of sites, conflicting consent applications have been lodged as well, thus slowing down the consenting process. Additionally from the analysis of existing project timelines, there is also relatively long period between the consent authorization and the start of construction (6.7 years on average[20]). This is due to difficulties in securing the required finances.

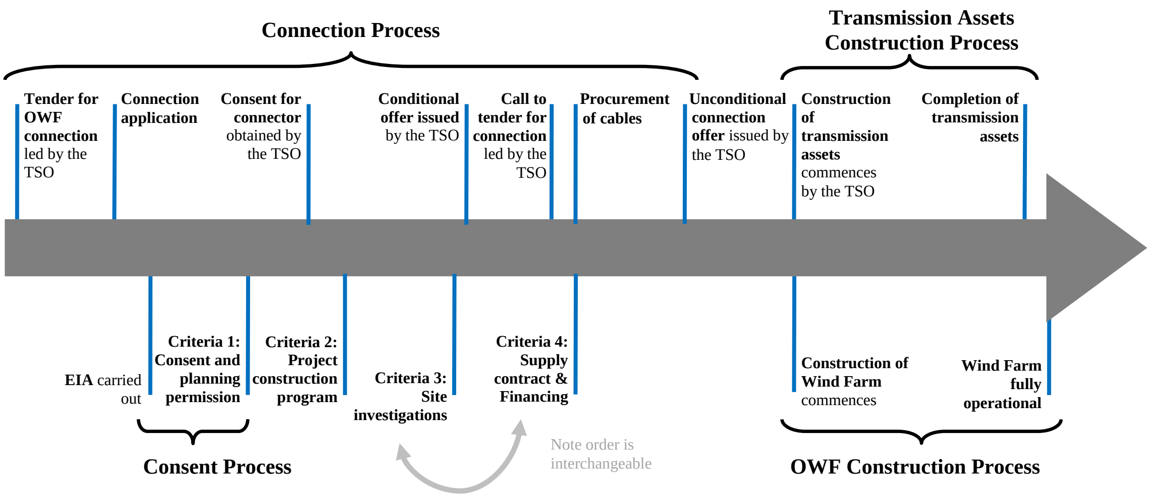
In 2006, the two German TSOs, TenneT and 50Hertz, in their respective areas became legally responsible for planning, consenting, designing, building and operating the offshore transmission system for all OWFs connecting at transmission level that begin construction before 2015[21]. The

[19] The transmission charging regime is currently under review.
[20] Source: Uhttp://www.4coffshore.comU averaged for 27 existing, under construction and consented OWF
[21] The policy for connection after 2015 is still under discussion. One of the options discussed is making the existing connection policy permanent. In such case, the deadline for commencing construction before 2015 is no longer applicable. (Uhttp://www.eref-europe.org/dls/pdf/2011/Kai_Schlegelmilch.pdfU)

offshore transmission system is funded by the TSO. This could reduce capital expenditure for a developer of an offshore project by 10-30% depending on the distance from shore[22].

The costs incurred by the TSO are distributed across all four German TSOs and recovered through transmission tariffs from the demand customers in each TSO area. Thus the TSO is, in principle, obliged to look for the most socio-economic solution for connecting OWFs as with any other transmission network reinforcement/expansion project.

In order to be connected to the network, the developer has to prove that the project has reached an adequate stage of development fulfilling four key criteria (consent and planning permit, project delivery program, site investigations, supply contract/financing). The tendering process for connection is designed to give the TSO an opportunity for a coordinated offshore transmission system approach where deemed more efficient. The structure of the tendering process also allows the system operator to consider further generators developing in the area. For example the TSO may decide to oversize the collective connection in anticipation of the upcoming projects. Even in this case the TSO funds oversized transmission system.



▪ **Figure 3 OWF development process in the Germany**

[22] Deloitte: Analysis on the furthering of competition in relation to the establishment of large off-shore wind farms in Denmark. Background report 1: Analysis of framework conditions in key EU countries. Available Uhttp://www.ens.dk/en-us/info/news/news_archives/2011/sider/20110429cheaperoffshorewindfarmsinsight.aspxU
Note that According to “A Guide to an Offshore Wind Farm” published by TCE transmission infrastructure for 500MW project constitutes about 20% of total project cost.

5.3. Denmark

In Denmark, 868MW of offshore wind power is currently operational with another 400MW under construction. The sites for OWF development are decided by the Government based on an Environmental Impact Assessment (EIA) and the onshore network access among other considerations. The sites are assigned through a competitive tender process led by the Danish Energy Agency (DEA). The TSO, Energinet.dk, is responsible for connecting the OWF of the preferred bidder and will fund the transmission assets from the offshore substation (including the step up transformer) to the onshore grid connection point. The costs will be recovered from all the demand customers in the country, through the transmission tariff. However, it should be noted that the OWF and the offshore transmission system development timelines set out in a call for tender are very challenging, while project termination or delays after tender award are subject to substantial penalties. This is one of the reasons for the sole bidder during the last tendering process of the Anholt OWF.

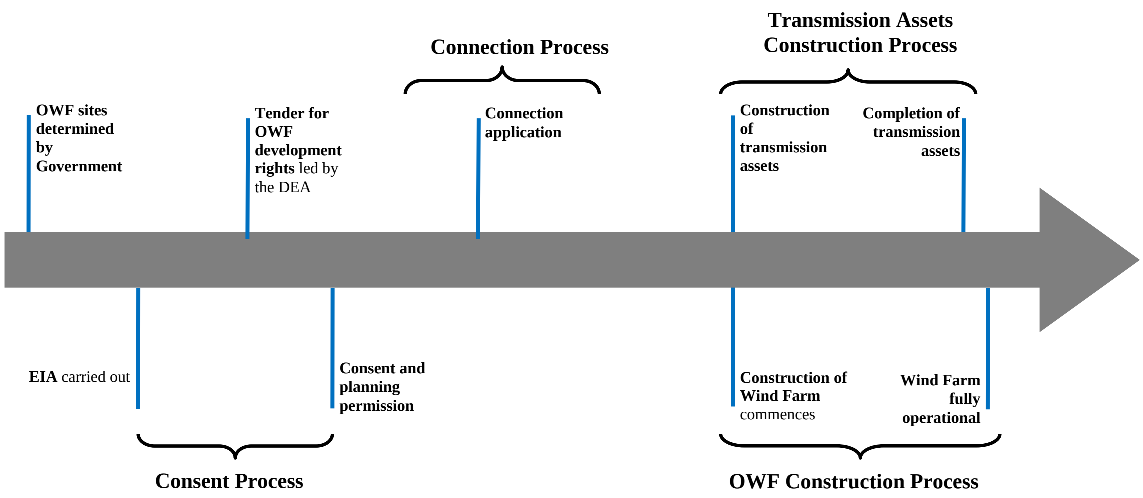


Figure 4 OWF development process in the Denmark

Figure 4 OWF development process in Denmark. Due to the design of the tendering process all projects are connected individually, i.e. point-to-point connections, and there is no actual or planned inter-project coordination or anticipatory investments. However Energinet.dk was actively involved in the pre-feasibility studies for the connection of the Kriegers Flak, a triple project on the EEZ borders of Sweden, Germany and Denmark. It is envisaged that the projects will be AC (alternating current) interconnected with HVDC (high voltage direct current) connections to each country. Although Svenska Kraftnät (SvK), the Swedish grid operator has pulled out, the German and Danish projects are still planning to go ahead. The German site is already under development and it is expected that the next tender in Denmark will be for a 600MW OWF at Kriegers Flak.

5.4. Netherlands

There is currently 247MW of offshore wind power in Netherlands, all connected to the distribution level[23]. No OWFs are under construction at present but nearly 3,000MW have obtained consent. The rights for development are granted through a competitive tendering process. To take part in this tendering process, the developer has to obtain a planning consent for the site. The winning bidders receive the SDE (Stimulation of Sustainable Energy Production) tariff. To date, two tendering rounds have been held. The third and most significant round was planned but did not commence due to political uncertainty and changes recently introduced to the feed in tariff structure. Developers would have looked to obtain consent in anticipation of the third tendering round, thus accounting for the number of projects in the 'approved' stage in Netherlands, Table 1.

In July 2011, the feed-in tariff system was changed and the first call to tender was launched for renewable energy generation under this new tariff SDE+. The SDE+ scheme is expected to be consumed by other renewable technologies. This is because the tariff is not deemed to provide sufficient returns compared to the high capital costs of offshore wind power. The economic crisis and the unsatisfactory tender results for the previous OWF tender rounds, including several objections and procedures in court, have reduced interest in offshore wind development and have resulted in new strategies by the government to reach the 2020 renewables targets.

The Dutch government approved the proposal to make TenneT responsible for the construction and management of the offshore transmission system (mid-February 2010). Pending the ratification of governmental decision, TenneT has been asked by the Minister of Economic Affairs to prepare itself as operator of the grid in the Dutch North Sea. The collapse of the Dutch government in 2010 was one of the reasons that no decision has been made with regard to amending the Dutch Electricity Act.

In December 2010 a bill was prepared, creating the opportunity for TenneT to connect OWFs to the onshore grid, where it is considered more efficient than construction and management by the free market players. There are no examples of instances when this would be considered a case. The bill also prescribes how the TenneT can fund and recover such investments[24].

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[23] Note Egmond aan Zee wind farm (108MW) is connected at 34kV and Prinses Amaliawindpark (120MW) is connected at 150kV, installed before the national transmission grid was extended to include the 110 and 150kV grids.

[24] Reply of the minister to advice of the taskforce 'offshore windenergy' (in Dutch). Uhttp://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2011/06/10/kabinetsreactie-op-de-adviezen-van-de-taskforce-windenergie-op-zee.htmlU

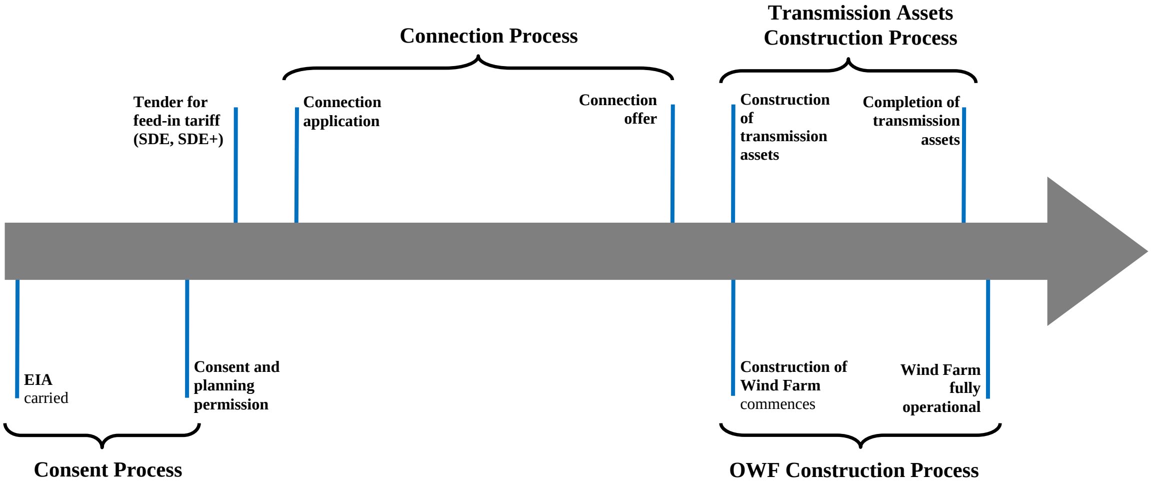


Figure 5 OWF development process in Netherlands

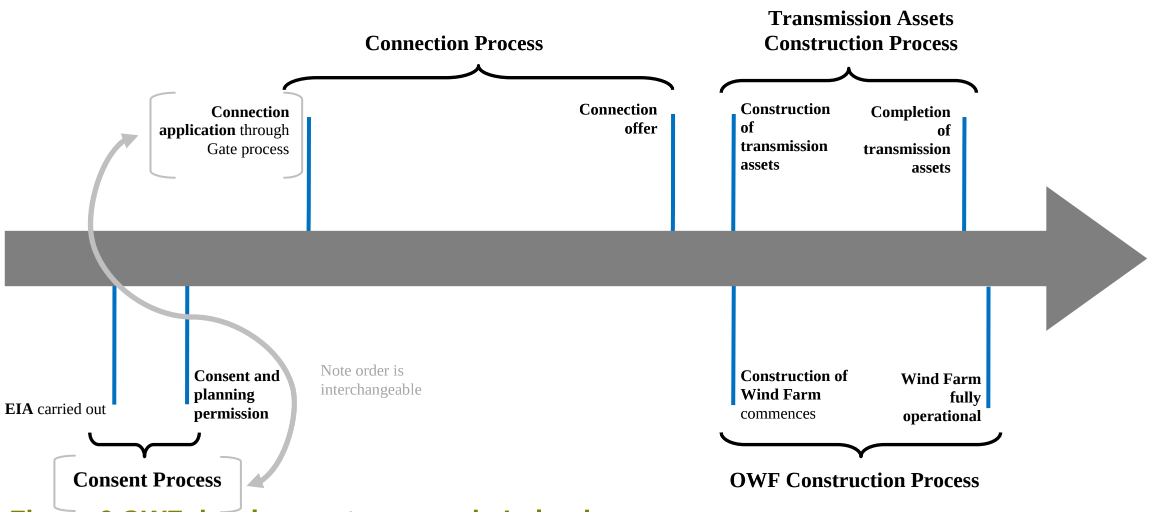
Currently all offshore transmission system costs are borne by the developer. Associated onshore transmission system reinforcements are funded by the TSO and recovered through transmission tariffs, currently levied on the demand customers. However, due to the increase of production capacity in the Netherlands there is an increasing call to change this in the near future.

5.5. Ireland

There is currently only one OWF in Ireland, the 25MW Arklow Bank Offshore Wind Park connected at the distribution level. There are no OWFs under construction, 1,595MW have been consented (i.e. approved) and a further 1,794MW are in the planning stage.

In December 2004, a "Gate" process was adopted whereby applications for connections are processed in batches. The latest Gate, Gate 3, had offers for 3,900MW of renewable generation capacity (795MW of this has been offered to offshore wind projects).

Most of the projects submitted under Gate 3 are at a very early stage of the development and their viability is uncertain. Notably the only two offshore projects that have received full site development rights (Codling Wind farm and Arklow 2) missed the Gate 3 process and therefore face the prospect of severe delays with their connections. On the other hand the three OWFs that received connection offers (Dublin Array, Oriel and Skerd Rocks) are still awaiting decisions on their consent applications.



- **Figure 6 OWF development process in Ireland**

OWF connecting to the national transmission system in Ireland fund the shallow connection charges, including the cost offshore transmission system. The cost of any shared offshore transmission assets is split on a MW basis. Connection to the national transmission system is done in date order, meaning that the earliest connection application submitted connects first regardless of size. In order to reduce network hoarding and to demonstrate commitment, generators must pay EUR 25,000 per MW of the MEC as a Capacity Bond. Generators connecting to the transmission system must also pay a Connection Charges Bond as financial security for the outstanding connection charges not paid by the consent issue date. This is distributed between the offer acceptance stage and the final energisation, and is drawn down if the project does not connect and EirGrid's costs incurred exceed the sums already paid.

5.6. USA

The USA is in the very early stages of offshore development and there are currently no OWFs in operation, 468MW are approved and another 3,269MW are planned. Therefore, at present, there are no specific offshore transmission connection procedures available. Notably there is a relatively developed (though barely tested) coordinated system for leasing the sea bed and consenting for offshore wind. This is led by the Department of the Interior's (DOI) Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE).

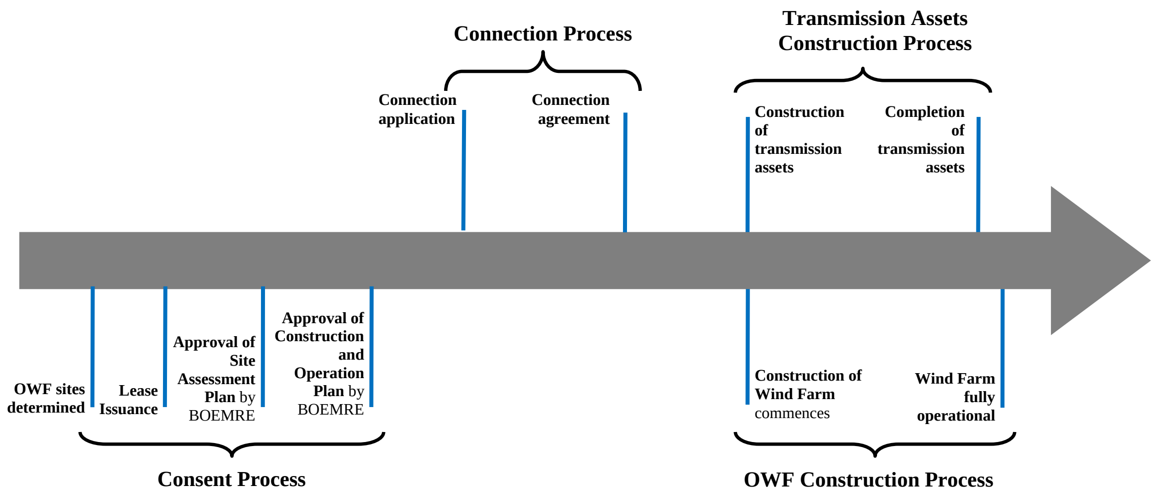
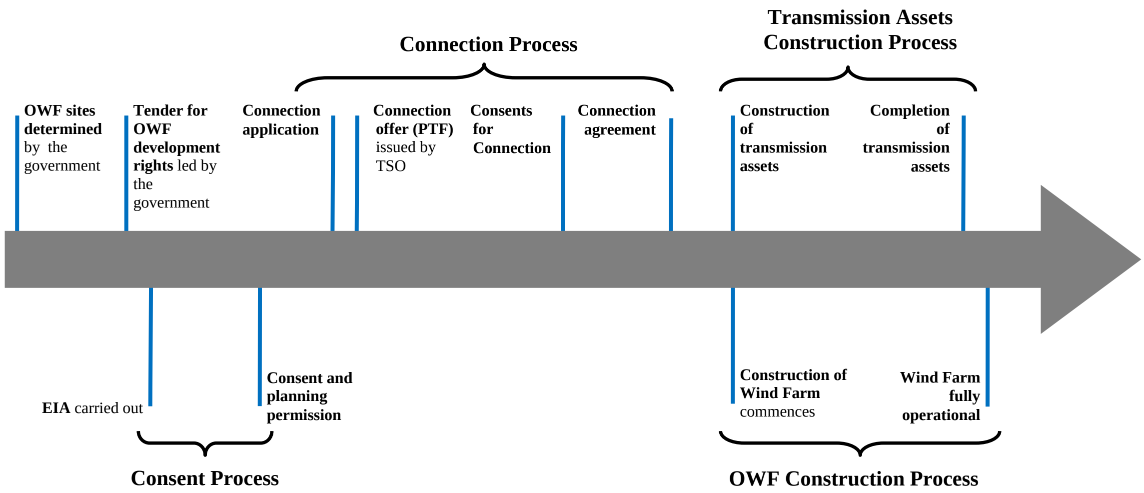


Figure 7 OWF development process in the USA

The Atlantic Wind Connection project is led by Trans-Elect (TSO and TAO) backed by strong financial sponsors, Good Energies, Google and Marubeni Corporation. They propose a 7,000MW HVDC "Backbone" which will serve as a number of nodes that offshore developers may use as their offshore connection point. The development is intended to accelerate offshore development and is intended to be expandable to accommodate future increases in capacity. The backbone will be tied into the strongest, highest capacity areas of the onshore grid to minimize reinforcements. Notably this project has taken the first step in submitting a right of way application to BOEMRE.

5.7. France

The development of OWFs in France is currently in the early stages. The French government has set a target to develop 6,000MW by 2020.

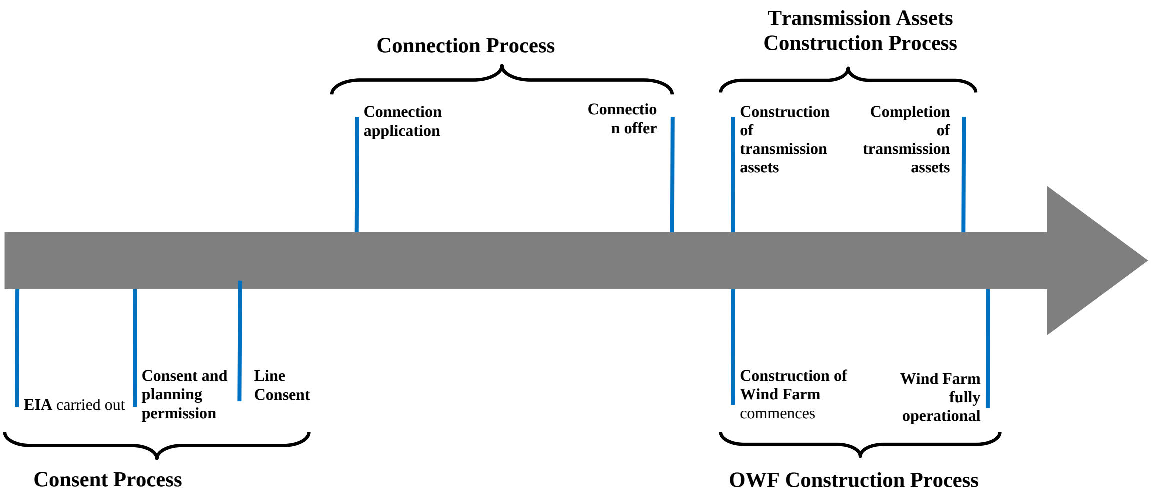


- **Figure 8 OWF development process in France**

To initiate the OWF development, the government issued a call to tender for five separate sites totalling 3,000MW of offshore wind power installations. The call was launched in July 2011 and the winners are expected to be selected in May 2012. A second call to tender is also expected around April 2012. The tender requires financial and performance guarantees from the bidders. The French TSO, Réseau de transport d'électricité (RTE), will fund, construct and own the connections. The costs of the offshore transmission assets will be recovered from the generator via connection charges. The costs of wider network reinforcements will be paid by all demand customers via TNUoS charges.

5.8. Sweden

Sweden has taken a pioneering role in the development of offshore wind. The world's first offshore wind turbine was installed at Norgersund, Blekinge in 1991. To date there are 130MW of offshore wind and 1,075MW of potential offshore wind capacity that has been fully consented though not yet under construction. Additionally there is one OWF with a capacity of 640MW that has obtained partial approval. Slow OWF development may be attributed to the offshore wind support schemes that are not as attractive compared to other countries.



■ **Figure 9 OWF development process in Sweden**

In line with the EU energy policy there should be business separation between the generator and the line (grid) connecting to the transmission or regional grid. The connection process is triggered by application from the generator. However all agreements (connection, construction, operation and transmission use of system) are signed between SvK (the TSO) and the line concession holder. SvK initially funds all the offshore transmission system costs and the costs of any associated onshore transmission system reinforcements necessary. These costs are then recovered from the line licensee via deep[25] connection charges that are passed on to the generators involved. Due to these arrangements, generators that are first to connect in the area where reinforcements are required have to pay the full cost of reinforcement while the next generator to connect only pays shallow[26] connection charges to use the readily available transmission capacity. In 2009, SvK made a proposal to the government to introduce certain changes to the energy law and to facilitate sharing of network reinforcement cost between all projects (current and future) benefitting from those reinforcements. The proposal is still under discussion.

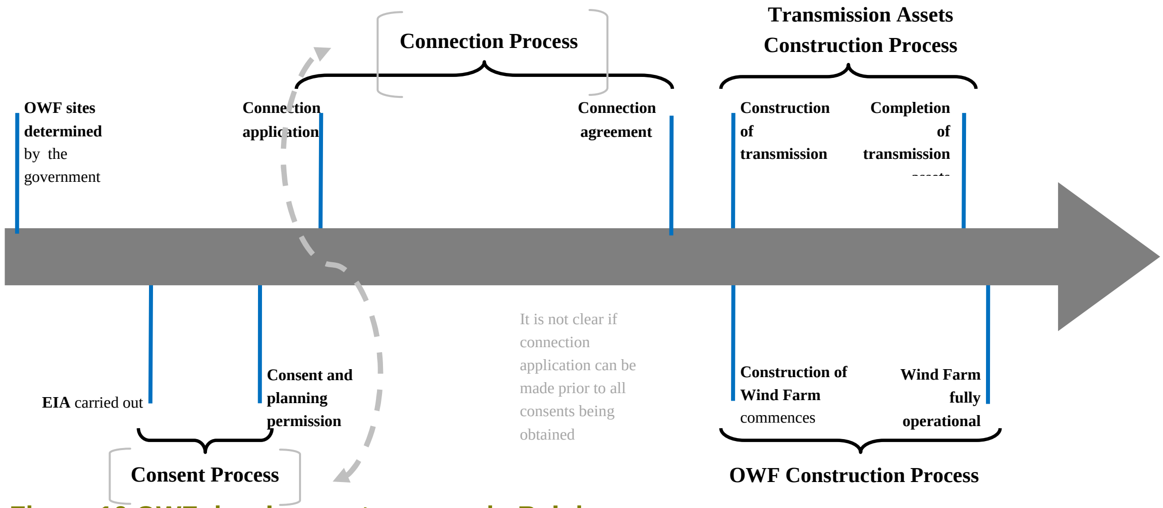
5.9. Belgium

At present, there are two OWFs in operation with a capacity of 195MW and a further 148MW under construction. There is also 529MW of projects that have already received consent (i.e. in the 'approved' stage). One of the reasons for the deceleration of offshore wind development is the fixed subsidy scheme. This provided relatively high support for the first offshore projects up to

[25] These are based on a combination of shallow charges (see definition below) plus the costs related to any additional wider ("downstream") network reinforcement, required to support the load/generation of the connected party.

[26] These are usually based on simply recovering the costs related to the physical connection assets between the connected part and (usually) the nearest network connection point.

total capacity of 216MW, but beyond this capacity the subsidy was substantially reduced. There are two other major issues that surround offshore developments: the constraints within the existing Belgium transmission system and the limited space arising from various conflicting activities at sea. This includes existing shipping routes, pipes and cables, nature reserves, naval exercise areas and fishing.



▪ **Figure 10 OWF development process in Belgium**

Notably the TSO will finance up to one third the cost of the offshore transmission cable, for a maximum EUR 25M for a project of 216MW or higher. The funding will be reduced proportionately if the project is less than 216MW. The cost of the offshore transmission cable includes the purchase, delivery and installation of the submarine cable, the connecting facilities and the equipment and junction cables between the wind turbines. The TSO's contribution to the offshore transmission system costs is financed by a surcharge applied to the transmission tariffs. Generators do not pay TNUoS tariffs and therefore all these costs are levied on to the demand customers.

5.10. China

Currently China is the world's largest wind power developer, with a total of 44,700MW of installed wind power capacity at the end of 2010, though there have been few OWF developments as of yet. The country has accelerated the development of offshore wind power. In June 2010, the first stage project of the Shanghai East Sea Bridge OWF went into operation, with a total installed capacity of 102MW. In September 2010 another wind farm Longyuan Rudong Intertidal demonstration project, 32MW went into operation.

The public tender for the 1,500-2,000MW offshore concession projects, totalling four OWFs in East China's Jiangsu province, was announced in October 2010. In the second half of 2011, China’s

National Energy Board (NEB) will initiate the second round of offshore wind power concession projects with a total installed capacity of 1,500 to 2,000MW.

Due to the early stage of development there is currently no dedicated offshore electricity transmission regulatory regime in China. The offshore transmission systems are developed and financed by OWF developers.

6. Comparative Assessment

In order to assist with the comparison of the offshore electricity transmission regulatory regimes, a high level matrix was created for the key aspects identified. The matrix was populated with information obtained from the review of the documents and studies available in the public domain. The review implied that, at present, specific offshore electricity transmission regulatory regimes exist only in three countries: Germany, Demark and GB. In the Netherlands, the USA, Ireland and France some steps are being taken to facilitate a coordinated approach for OWF connections. In the remaining countries there is neither an existing or planned dedicated offshore electricity transmission regulatory regime. The matrix was thus split according to the stages of the offshore electricity transmission regulatory regime development. For the three leading countries, the majority of the matrix is presented below while for the remaining countries only the key points of the current/expected regulatory regimes are highlighted.

6.1. Great Britain, Germany, Denmark

6.1.1. Transmission assets classification, ownership and operation and maintenance (O&M)

6.1.1.1. How the offshore transmission assets are classified

This subsection aims to answer two questions:

- Is "transmission" classified the same onshore and offshore (same voltage levels)?
- Are the lines connecting OWFs to the onshore transmission system classified as:
  - transmission;
  - part of the generating substation;
  - distribution; or
  - international interconnection?

In GB, undertaking offshore transmission is a prohibited activity for which either a licence or an exemption is required. DECC has put in place a legal structure, which amends various definitions relating to offshore transmission, to ensure that all lines conveying electricity generated offshore at or above 132kV in internal waters, territorial waters and/or the Renewable Energy Zone (REZ) are regulated under the offshore electricity transmission regulatory regime.

Under the offshore electricity transmission regulatory regime, which is currently partially commenced, any electric line operating up to and including 132kV in England and Wales (and up to but not including 132kV in Scotland) that is in territorial waters, is defined as distribution and exempt from any licensing regime under the Class Exemptions Order 2001 for offshore distribution until transfer of assets to an OFTO, and classified as transmission thereafter. This has ensured flexibility in asset transfer and helped to ensure full operation of any transitional project assets, as the new provisions apply to generator built assets only after these are transferred to an OFTO.

In Denmark and Germany transmission system operators are responsible for design, construction and operation of the transmission infrastructure between the wind farm offshore connection point and the onshore connection point. Therefore the offshore transmission system is considered to be part of the overall national transmission system, as in GB.

In all but one of the studied countries no distinction is made for the classification of offshore and onshore transmission voltages. In Germany the 155kV level is also considered as offshore transmission in addition to the onshore transmission voltages of 220/380kV. Both the existing OWFs in Germany came into operation after the TSOs were appointed by law to design, construct and operate the offshore transmission system. Thus there was no need to specify flexibility for transitional projects as for GB.

- **Table 3 How offshore transmission assets are classified**

	GB	DE	DK
Offshore transmission voltage levels	132kV (but only after asset transfer to an OFTO) and higher Note before transfer, 132kV is currently classified as distribution (will become transmission at full commencement of the regime)	155kV and higher	132kV, 150kV and 400kV

6.1.1.2. Ownership of offshore transmission assets

The issue of ownership of the offshore transmission assets in Denmark, Germany and GB is covered in the table below. In Denmark and Germany, offshore transmission assets are owned by the respective TSOs. In GB, the ownership remains with the developer (if the developer is constructing the assets under the generator build option) until transfer of assets to an OFTO or with the OFTO if the OFTO constructs the assets.

▪ **Table 4 Transmission ownership**

Country	Who currently owns the offshore transmission assets?	Who owns the offshore transmission assets (after March 2012)?
GB	Under the transitional regime and for the "generator build" option, ownership of the offshore transmission assets (132kV and over) remains with the developer until the OFTO is chosen through the competitive tendering process. Once this occurs, the ownership is transferred to the OFTO for 20 years. Thereafter an OFTO license can be prolonged; a new party can be appointed; or other bilateral solutions implemented. The Authority will consider the most appropriate option which provides certainty to both the developer and the OFTO; allows efficient cost funding; facilitates the efficient use of assets; and protects the consumers.[27]	No change
DE	TenneT Offshore and 50Hertz Offshore are responsible for the construction and operation of offshore transmission system. TenneT and 50Hertz (TSO) are the owners in respective regions	No change
DK	Offshore Energinet.dk is responsible for construction and operation of the offshore transmission system (132kV-400kV). Energinet.dk or Regional Transmission Companies (RTC) owns the offshore transmission assets.	No change

6.1.1.3. Operation and maintenance of offshore transmission assets

In Germany and Denmark operation and maintenance (O&M) of the offshore transmission system resides with TSOs. The TSO in Germany may also contract for a third party to provide maintenance of the offshore transmission system.

For GB, the O&M of the offshore transmission system resides with the OFTO; however maintenance can also be contracted to the Generator. Currently in the transitional regime, the OWF developer is responsible for the O&M of the offshore transmission system until the OFTO is appointed.

▪ **Table 5 O&M of the offshore transmission system**

	GB	DE	DK
Generator	√ (maintenance) if contracted by the OFTO		
TSO		√	√
OFTO	√		
Third Party Provider	√ (maintenance) if contracted by the OFTO	√, if contracted by the TSO	

[27] Government response to consultations on offshore electricity transmission, Uhttp://www.decc.gov.uk/assets/decc/Consultations/offshoreElectricityTransmission/1031-govt-response-cons-offshore-electricity.pdfU

6.1.1.4. Pre-construction works

In the "Offshore Electricity Transmission: Further consultation on the Enduring Regulatory Regime Overview from August 2010"[28], Ofgem considers that pre-construction works could include and be limited to:

- carrying out an EIA and stakeholder consultation in relation to the OFTO works;
- obtaining necessary planning permissions;
- obtaining necessary landowner consents (leases, easements, wayleaves, etc);
- carrying out engineering surveys (onshore and offshore) in relation to the OFTO works (these could include sea-bed geophysical and geo-technical surveys and metocean surveys);
- carrying out high level engineering design needed prior to undertaking the activities described above; and
- any economic analysis in support of this high level engineering design.

It should be noted that Ofgem will define the scope of pre-construction costs on a case-by-case basis and assess their economic and efficient value.

The TSO in Germany and Denmark is responsible for carrying out any pre-construction works for offshore transmission system. In GB this is the responsibility of either the OFTO or the generator depending on the timing of the OFTO appointment.

Table 6 Responsible for carrying out pre-construction works

	GB	DE	DK
Generator	√[29] (if generator build and late OFTO)		
TSO		√[30]	√[30]
OFTO	√[29] (if early OFTO)		

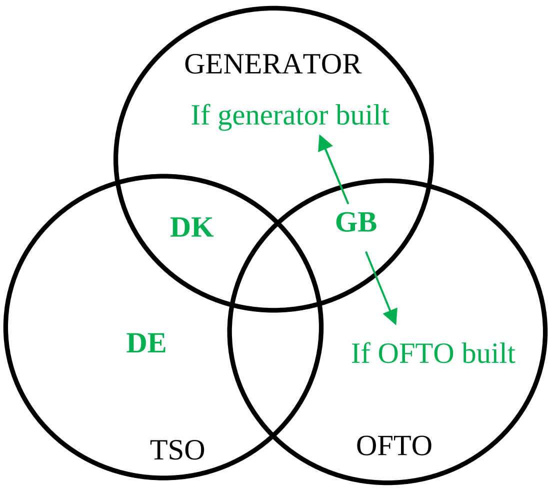
[28] Offshore Electricity Transmission: Further consultation on the Enduring Regulatory Regime Overview from August 2010 Available at: Uhttp://www.decc.gov.uk/assets/decc/Consultations/offshoreElectricityTransmission/424-condoc-offshore-electricity-transmission.pdfU

[29] Note for Round 3 offshore development zones in GB, TCE will fund up to 50% of pre-consent development costs. Once these consents have been granted, the involvement of TCE will end, leaving the zone developer to manage construction and operational activities.

[30] EIA, consenting and detailed design for offshore substation, transmission lines and onshore substation.

6.1.1.5. Construction of the offshore transmission system

Figure 11 below illustrates the responsibilities for construction of the offshore transmission systems in GB, Denmark and Germany. Under the enduring offshore electricity transmission regulatory regime in GB, the generator may choose to build the offshore transmission system or for an OFTO to be appointed though competitive tendering process. In the latter case the OFTO will construct the offshore transmission system. For Germany, the TSO is obliged by law to construct the offshore transmission system if deemed more efficient. In Denmark two approaches exist in principle. Firstly, if the site concession is obtained through a competitive tender process then the TSO is responsible for construction of the offshore transmission system. Alternatively, independent applications can be made for any site at any time, though for this case the developer will be responsible for the planning, consenting and construction of the offshore transmission system.



- **Figure 11 Construction of offshore transmission system**

6.1.2. Offshore transmission planning and standardisation of transmission assets

Since the German and Danish TSOs are responsible for the design, construction and operation of the offshore transmission system, the overall design of the offshore transmission system is also a part of the overall transmission network development plan. These are included in the European Network of Transmission System Operators for Electricity (ENTSO-E) Ten Years Network Development Plan (TYNDP). The German offshore transmission system design includes collective connections for several projects while, for Denmark, point-to-point connections for each project are envisaged.

There is no overall offshore transmission system design in GB. Although statements are in place to provide information on the design, this is not in the shape of a blueprint. To facilitate the coordinated development of the onshore and offshore transmission systems, there is a new license obligation requiring the National Electricity Transmission System Operator (NETSO) to develop an annual Offshore Development Information Statement (ODIS). The statement includes a wide range of information relating to possible development of both the offshore and onshore transmission systems: generation scenarios, applicable technology, offshore transmission system design and onshore transmission coordination. Since the publication of the 2010 Statement, NGET has undertaken a conceptual design study into the development of an integrated offshore transmission system in addition to point-to-point connections.

Additionally steps have been taken to investigate onshore transmission system reinforcements required to meet 2020 renewable targets. The Electricity Networks Strategy Group[31] (ENSG) (a cross industry group jointly chaired by the DECC and Ofgem) have, among other tasks, produced the "Strategic Reinforcements Required to Facilitate Connection of the Generation Mix to the GB Transmission Networks by 2020" report[32]. The reinforcements identified by this report are based on a range of scenarios that examine the potential transmission investments associated with the connection of large volumes of onshore and offshore wind generation, required to meet the 2020 renewable targets and new nuclear generation. To ensure that the critical investments needed to facilitate the achievement of the 2020 targets are not delayed as a result of regulatory or funding considerations, Ofgem through the Transmission Access Review has developed the Enhanced Transmission Investment Incentives (TII) which consider application for funding for both pre-construction works and construction works in a staged manner, under the current transmission price control.

At the end of September 2011 the TCE and National Grid published an Offshore Transmission Network Feasibility Study[33] to identify and assess the feasibility, benefits and challenges of adopting a more coordinated approach to the development of offshore transmission system. The coordinated design presented in that study is based on the installation of high voltage multi-user assets that interconnect the offshore substations to form an offshore transmission system that is fully integrated with onshore transmission system requirements. This conceptual design highlights how the volume of assets installed offshore could be reduced whilst the need for onshore reinforcement is minimised. The designs present an illustrative coordinated transmission design approach and have been developed to allow a comparison between the potential design options.

In Germany, a series of strategic grid studies have been commissioned by Deutsche Energie-Agentur GmbH (DENA), the German Energy Agency. The studies aim to identify the long-term

[31]Electricity Network Strategy Group: Uwww.ensg.gov.ukU

[32] Note this was published in 2009 and the report is currently being updated.

[33] Note that due to the time of publication the Offshore Transmission Network Feasibility Study is only mentioned here but not considered in detail in this report.

consequences of an increased share of renewable energy on the electrical system, including the required grid upgrades and extensions. The DENA grid study has a similar purpose and status as the ODIS and ENSG report. Notably some of the onshore reinforcements recommended through the DENA study are already under construction.

Although the Kriegers Flak feasibility study is mentioned in Table 7 below, it is not an overall offshore transmission system design study and it is only focused on the connection of one project. However it also includes potential interconnection of German, Danish and Swedish OWFs[34]. The study was undertaken by all three TSOs of the involved countries. The German site is being developed at present and the next tender in Denmark is to be held for the development of the Danish Kriegers Flak OWF.

- **Table 7 Offshore transmission system overall design**

	GB	DE	DK
Is there overall offshore transmission system design	No, but ODIS has been produced	Yes	Yes
Source/report	ODIS	(a) Transmission network development plan as a part of ENTSO-E TYNDP, (b) DENA Grid Study I and II, (c) An analysis of the offshore transmission system at Kriegers Flak in the Baltic Sea	(a) Transmission network development plan as a part of ENTSO-E TYNDP (b) An analysis of offshore transmission system at Kriegers Flak in the Baltic Sea
Organisation producing	NGET	(a) TenneT, 50Hertz (b) German Energy Agency (DENA) (c) 50Hertz	(a), (b) Energinet.dk
Is it obligation/research activity?	Obligation	(a), (c) Obligation. (b) Initiative of interested stakeholders	Obligation
Status	A range of connection configuration scenarios suggested for future offshore transmission system development (no obligation to follow suggested designs or recommendations)	(a) Development plan (b) Recommendation, (c) Feasibility study	(a) Development plan, (b) Feasibility study

[34] Though interconnection to Swedish site is included in the study, it is unlikely that it will be developed in the nearest future due to lack of interest from potential investors.

	GB	DE	DK
Includes inter-project connections?	Yes	(a)&(b) Collective connections	No
Includes inter-zone connections?	Yes	No	N/A
Includes International Interconnections of OWF?	No	(a), (b), (c) Yes though Kriegers Flak	(a), (b) Yes though Kriegers Flak
Considers necessary reinforcements onshore?	Yes	(a), (b) Yes, (c) No	(a) Yes, (b) No
Issue date of the latest version	Sept 2011	(a) Jun-10, (b) Nov-2010 (c) Feb-2010	(a) Jun-10, (b) Feb-2010
How frequently updated?	Annually	(a) Annually (b),(c) Single study	(a) Annually (b) Single study
Voltage that the overall design covers	132kV and over	≥150kV	150 or 220kV

6.1.2.1. Standardisation of transmission assets

Current practice is to match the size of offshore transmission system design to that of the generation development. In a more standardised approach the development would be matched to standard connection module size.

If such an approach was taken then it would be expected that benefits that are normally associated with a standardised approach could be achieved and delivered on a project by project basis. Where the standardisation of capacity is not possible, benefits could still potentially be achieved by standardising equipment types and arrangement, and platform design with only minimal adjustments to capacity and ratings where necessary.

The standardised approach would cover most aspects of the transmission connection and could include:

- Size of connection capacity (For example this has been standardised at 400MW in Germany)
- Electrical system design, although onshore compensation requirements would be determined by connection distances and onshore network.
- Design philosophies e.g. auxiliary power provision, control and protection, condition monitoring, fire protection systems, emergency systems, provision for operation and maintenance etc.
- Equipment ratings (switchgear, transformers, auxiliary equipment)
- Offshore platform design

- Export cables ratings and technology

Potential advantages of a standardised design approach would be:

- Ability to achieve lower capital costs for the offshore transmission connection through using standard designs and repeatability in design, procurement, engineering, production, installation and commissioning phases.
- Lower operational costs for the standardised connection (reduced training, spares and optimised and enhanced design reliability).
- Lower project risk as designs are already proven

To achieve cost savings of the total cost of the transmission connection the standardised approach would have to be applied across numerous projects, but if done then the overall savings could be significant.

References linked to quantification of such benefits are not easily found, however in some respects the benefits of standardisation would be comparable to the benefits of a Standardised Bay Design approach reported by National Grid[35]. It is suggested that the cost benefit of adopting the standard bay approach could potentially yield savings on an individual bay basis of 15-20% when implemented on a large volume basis. It would be expected that for offshore transmission connections a similar level of savings could be achieved.

A potential disadvantage with standardisation is the more difficult management of innovation in design. The balance between the benefits of standardisation and need for innovation is addressed in the work of CIGRE WG B3.11[36] although specific quantification of benefits is not provided.

For Operational Expenditure similar levels of percentage savings, and potentially more, could be achieved if the standardised approach was applied to designs. The savings would of course be realised throughout the operational lifetime of the asset but would also include the decommissioning cost element.

Currently, there is no actual standard for dimensioning of offshore transmission assets in any of the studied countries. For GB, the ODIS suggests several standard platform/block sizes. According to NGET's Grid Code, the nominal National Electricity Transmission System voltages are 400, 275 and 132kV. However there is no equivalent definition for offshore transmission system voltage.

In Germany, voltages for the offshore transmission system are standardised through the grid code as 155, 220 and 380kV. The size of the OWFs (400MW) seems to be governed by the "Standard

[35] M. Osborne "The Use of Standard Bay Designs to Achieve Lifecycle Efficiencies Within National Grid Transco" CIGRE 2004 Paper B3-206.
[36] CIGRE Brochure No 389 "Combining Innovation with Standardisation".

for design of OWFs" report, issued by the Federal Maritime and Hydrographic Agency. The standard limits the number of turbines developed at one site to 80, thus limiting OWF capacity to 400MW, with current wind turbine technology. In Denmark, the grid operator recommends that OWFs are built at a minimum size of 400MW in order to bring the cost of the offshore transmission system down. This advice was followed by the government for the Anholt project.

- **Table 8 Standardisation of transmission assets**

	GB	DE	DK
Outlined where?	The ODIS promotes the use of standard blocks	"Requirements for Offshore Grid Connections in the Grid of TenneT TSO GmbH" (for voltage), "Standard for design of OWFs" (for OWF size)	No standardisation
Status	Grid Code	Grid Code	N/A
Platform/block size	AC500, AC600, AC900, HVDC1000, HVDC2000[37]	400MW (not clear if standard of just practice)	200MW blocks (recommended by TSO)
Connection capacity	No standardisation, but block sizes are recommended, see above	80 WT, 400MW (not clear if standard of just practice)	400MW or more, in 200MW blocks (recommended by TSO)
Offshore transmission system voltage	132kV and above, no standardisation of voltage levels	155kV, 220, 380kV. In single cases other voltages are possible.	150kV or 220kV
HVAC or HVDC	Both	Both	Both

For an integrated offshore transmission network, a higher degree of standardisation of transmission assets is required. This would particularly apply to HVDC where operating voltages need to be standardised and in case different suppliers' HVDC equipment is connected to a DC grid then the communication between control systems needs to be compatible.

Such standardisation could be facilitated through CIGRE working groups leading to International and national standards.

[37] AC500, AC600, AC900 refers AC offshore substation designs dimensioned for 500MW, 600MW and 900MW respectively; HVDC1000, HVDC2000 refers to HVDC offshore substation designs 1,000MW and 2,000MW respectively.

6.1.3. Connection process

In all three countries the generator triggers the connection process by submitting an application to the TSO. It is difficult to compare time scales for the connection process as the definitions are different for each phase. In GB there are two stages to the offshore connection process, one prior to the competitive tendering process for OFTO appointment (which takes one year) and one thereafter. When the generator applies for connection, the NETSO should issue a connection offer within 3 months and the developer has 3 months to accept or reject it. Thus the connection process itself takes 2 x 6 months, with approximately one year in between for the OFTO tendering process. There is no general information regarding timescales for the connection itself, as this is likely to have large variations from project to project. When the OFTO is appointed there is the ability to vary the connection agreement, and again the NETSO has three months to issue the Agreement to Vary (AtV) and the generator has three months to accept.

In August 2010, the UK Government introduced an enduring 'Connect and Manage' grid access reforms. This built on successful interim arrangements previously introduced by Ofgem, and allows a project to connect based on the time taken to complete its 'enabling works' (i.e. ahead of the completion of wider national transmission network reinforcements, which will be completed at a later date). A number of offshore projects have benefitted from this approach.

In Germany a tendering process, to obtain connection for the OWFs, is held twice a year. To enter the tendering process, a generator has to fulfil 3 out of the 4 criteria which have been designed to verify the "likelihood" of the project going ahead. For all generators that have achieved 3 of the 4 criteria, conditional connection offers will be made. These generators have to fulfil the fourth criteria, within 6 months, to receive an unconditional connection offer. TSO has 30 months from the connection application to build a connection for the generators that have fulfilled the 4 criteria.

Similarly in Denmark, challenging time scales are set out for the developer and the system operator as part of the tender conditions (for rights to develop an OWF, decided by the Government). The offshore transmission system has to be established by Energinet.dk within 2-3 years from tender award.

- **Table 9 Connection process**

	GB	DE	DK
Who triggers connection process? And how?	Generator by application to the TSO	Generators by application to the TSO by a specified deadline	Generator. Once the tender for the OWF development rights is awarded, the TSO is obliged to connect.
Can connection process be initiated by one party on behalf of another?	No	No	No

	GB	DE	DK
What are the timescales for connection process?[38])	Max 2 years (including OFTO tendering process and excl. building of the offshore transmission system)	Max 2.5 years (incl. building of the offshore transmission system)	Avg. 2-3years from tender award (incl. building of the offshore transmission system)
How the coordination between the individual wind farm offshore transmission systems is achieved?	Currently point-to-point connections. In the future joint connections may be required by NETSO where deemed efficient.	There is process with 2 cut off dates per year. All projects applying on the same cut off date will be coordinated in terms of offshore and onshore transmission system if economically beneficial.	point-to-point connections only

6.1.4. Shared transmission assets

Sharing of offshore transmission assets is in the early development stage and there has been no precedent in any of the studied countries[39]. In principle, under the current offshore electricity transmission regulatory regime in Germany, the TSO can decide to have shared transmission assets between several OWFs if deemed more efficient. The ownership of the shared transmission assets remains with TSO. Currently TenneT has started construction for the first offshore transmission line (800MW, 125km offshore, and 75km onshore) that will be shared between two OWFs in the North Sea.

The “Further Consultation on the Enduring Regulatory Regime” by DECC and Ofgem in August 2010 states that in the future NETSO may propose, in the connection offer, a joint connection solution for several projects if deemed more efficient. In this case Ofgem would expect the parties to reach a contractual agreement which would allow the overall solution to be delivered in accordance with NETSO’s planning assumption requirements.

The Kriegers Flak feasibility study, mentioned above, proposes an interconnection between Denmark, Germany and possibly Sweden. Although this suggests that transmission assets will be shared between three projects in three countries, a detailed approach has not yet been developed. There are also different feed-in tariff structures in all three countries and the issue of trading

[38] “Connection process timescales” refer to the time it takes from the submission of connection application to the national TSO until the connection offer is made to the developer. The time it might take to fulfil all necessary requirements to apply for connection (e.g. consenting, securing of finances etc.) is not included.

[39] In GB, Lynn (97MW) and Inner Dowsing (97MW) OWF share onshore transmission infrastructure. The projects whilst started by two different developers however at some point were taken over by one of the developers, Centrica. Both projects are also 33kV connected.

renewable energy between the countries is yet to be resolved. Construction of the German part of the project is expected in 2012[40].

- **Table 10 Shared transmission assets[41]**

	GB	DE	DK
Does shared use of assets extend to non-transmission related assets (such as vessels etc?)	N/A	Theoretically as shared transmission assets are developed by one body (TSO)	N/A
Shared use of inter-zone assets now	No	No	No
shared use of inter-zone assets proposed	No (but ODIS sets out scenarios)	No	No
Shared use intra-zone assets now	No	No	No
Intra-zone assets shared use proposed	No (but ODIS sets out scenarios)	Yes (both TenneT and 50Hertz are planning to have collective connections)	No
Shared use of assets between countries	No	Yes, proposed for Kriegers Flak	Yes, proposed for Kriegers Flak
Shared use of assets with onshore infrastructure	Proposed	Proposed for collective connections in TenneT and 50Hertz areas	No
Are there current/future plans to trade renewable energy with other countries?	No	Yes via Kriegers Flak. Note however different feed-in tariffs apply in Denmark and Germany. This is yet to be resolved.	Yes via Kriegers Flak. Note however different feed-in tariffs apply in Denmark and Germany. This is yet to be resolved.

6.1.5. Anticipatory investment and oversizing

"Anticipatory investment would allow the transmission asset owners to invest, before the need is established through firm commitments of new generation to connect and pay TNUoS charges. Under this arrangement, transmission network companies would make speculative investments in network reinforcements to accommodate growth in renewable generation."[42]

Ofgem, under the Transmission Access Review, has developed an Enhanced TII to ensure that the critical investments for GB's onshore transmission system reinforcement, needed to facilitate the

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[40] According to Uhttp://www.4coffshore.comU as of July 2011
[41] See Deliverable 2 report for the examples of the proposed projects sharing offshore and onshore transmission assets.
[42]R. Moreno, et.al., Making Room for the Boom, IEEE Power & Energy Magazine, Sep/Oct 2010.

achievement of the 2020 targets as identified by the ENSG study, are not delayed as a result of regulatory or funding considerations. The Enhanced TII considers applications for funding both pre-construction works and construction works in a staged manner under the current transmission price control. Note that not all investments that have been identified by the ENSG will necessarily go ahead.

The structure of the tender process in Denmark does not make provision for anticipatory investment.

In Germany, oversizing of the offshore transmission system (generally planned for future collective connections) is permitted if deemed economically efficient. Note that for any new offshore transmission system (oversized or not) to be built at least one OWF has to apply for connection and fulfill the 4 connection criteria. The decision may be taken by the TSO to oversize offshore transmission system in anticipation of future OWFs developing in vicinity (that have not yet applied for connection), if these OWFs hold planning permit at the time when decision is taken. Understandably, the consideration is given to the geographic location of the OWFs, technical and economic feasibility. It is envisaged that in the future the TSO may chose to build collective connections with the highest technically possible connection capacity, to achieve economy of scales, if deemed efficient. The "free" capacity will then be tendered for by the OWFs that are planned in the vicinity.

Following the DENA Grid Study I and II in Germany, onshore grid reinforcements are taking place in anticipation of OWFs developing in the North and Baltic Sea.

- **Table 11 Anticipatory investment, oversizing**

Anticipatory Investment			
	GB	**DE**	**DK**
What process is followed to determine where anticipatory investment should occur	The TAO can apply to Ofgem for funding of anticipatory onshore reinforcements identified by ENSG study. Anticipatory investment of the offshore transmission assets is currently discussed in the context of the OTCP.	Anticipatory investment for a new offshore transmission system(s) will not occur since the 4 criteria have to be met by at least one OWF for the offshore transmission system to be built. Onshore reinforcements have begun following the DENA study.	The Vision 2025 plan set out locations for future OWFs and performed the EIAs/other research to ensure that the OWFs can be built as quickly as possible. 26 sites were determined by the last update, in 2008. As of yet no anticipatory investments have been made.

Oversizing or other arrangement			
Is oversizing or other arrangement taking place /will take place to help ensure future proofing	Ofgem would consider whether initial over-sizing was economically and efficiently incurred and so eligible to be included within the transfer value. In addition the incremental capacity incentive provides scope for an expansion of up to 20% of bid costs once the project is operational.	Oversizing of collective connection is permitted if deemed economically efficient. The TSO may decide to oversize the collective connection if deemed economically efficient, provided that there is at least one OWF fulfilling all 4 connection criteria and other OWF(s) (who have not yet applied for connection) in the vicinity holding planning permit(s) and consent(s).	No

6.1.6. User commitment/financial security, Transmission charges

Table 12 and Figure 12, Figure 13, Figure 14 below detail the commitment of the stakeholders involved, financial guarantees required and transmission tariffs in the three countries. In Germany, the TSO doesn't require any financial guarantee from the generator. Before the TSO begins any connection works the generator has to fulfil the 4th criteria that ensures that the developer has a contract (or a binding order) for all wind turbines and either finances for the first year of construction or binding orders for the other major components (transformer, substation platform, internal cabling, etc.). The TSO, alongside the developer, will also develop a detailed project implementation schedule and coordinate during project delivery. It should be noted that the TSO builds the connections ahead of the OWF construction, see Section 6.1.8, and thus is exposed to higher risk if the project is not developed. There are only two operational OWFs at the moment and so far there has been no experience of stranded assets.

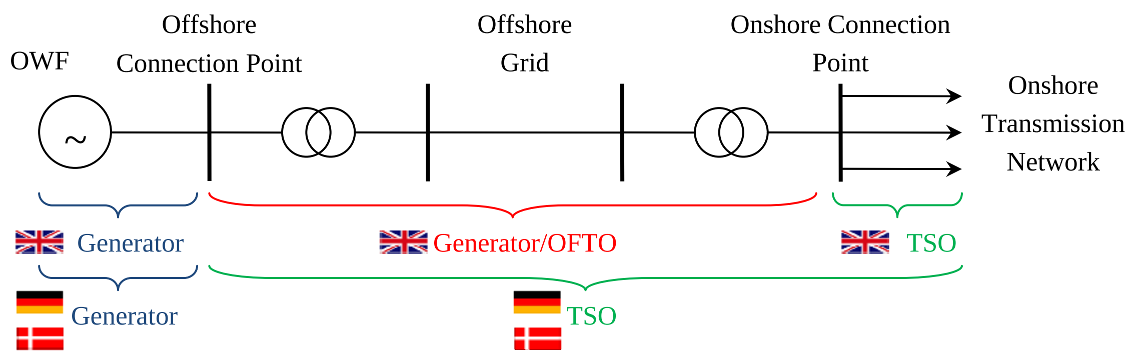


Figure 12 Who funds the transmission infrastructure?

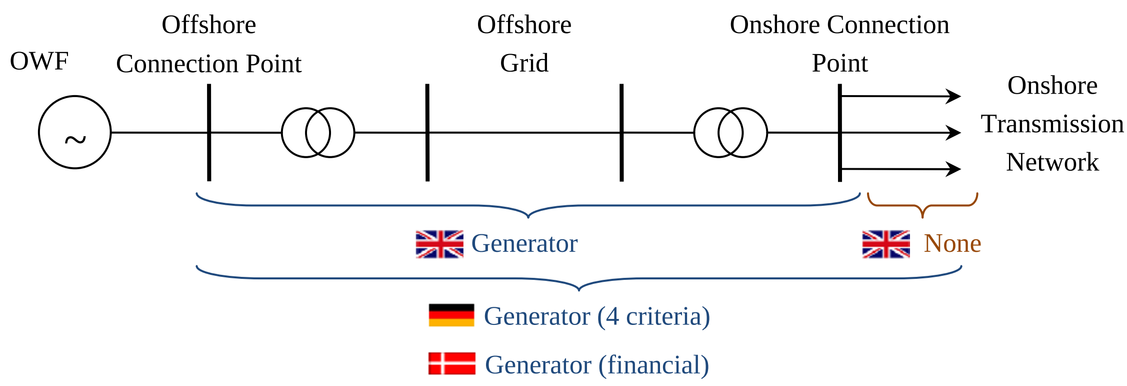


Figure 13 Who guarantees the investment?

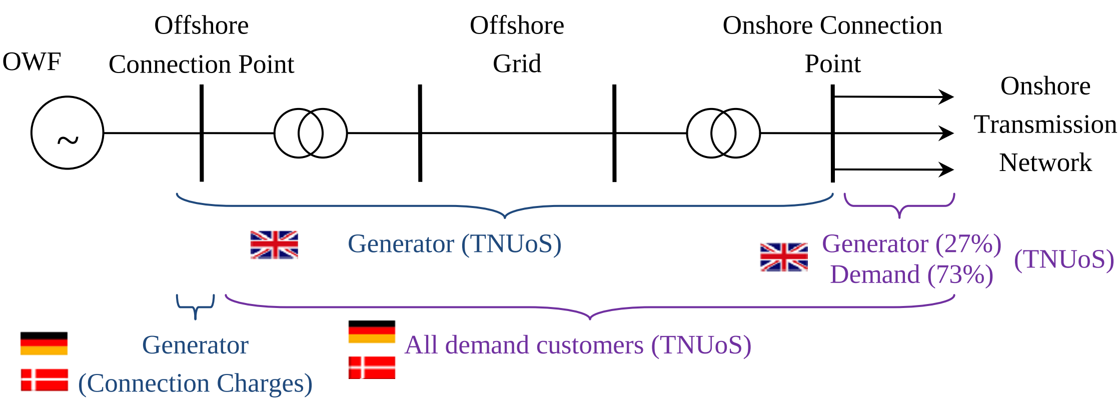
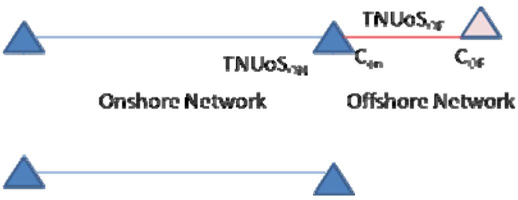


Figure 14 Who pays transmission charges?

In Denmark, the financial guarantees required from the generator are relatively high. Combined with tight project schedules this is reported as one of the reasons into why the Anholt OWF tender only had a single competitor.

Figure 15 schematically shows offshore and onshore system and where transmission charges for offshore generator may apply.



▪ **Figure 15 Transmission charging of offshore generators**

The details of transmission charges applicable to offshore generators in each country are shown in Figure 14 and further clarified in Table 12. In Denmark and Germany, the generator pays shallow connection charges at the offshore connection point. At present, generators in GB pay a locational TNUoS charges at the onshore connection point which includes use of the offshore transmission system. Transmission charging in GB is currently under review.

▪ **Table 12 User commitment, financial security, and transmission charging.**

<table>
<tr><th></th><th>GB</th><th>Germany</th><th>Denmark</th></tr>
<tr><td colspan="4">Who funds the investment?</td></tr>
<tr><td>Offshore Connection Point</td><td>Generator or OFTO</td><td rowspan="4">All elements: TenneT or 50Hertz</td><td rowspan="4">All elements: Energinet.dk</td></tr>
<tr><td>Offshore Transmission System</td><td>Generator or OFTO</td></tr>
<tr><td>Onshore Connection Point</td><td>TSO</td></tr>
<tr><td>Onshore Transmission System</td><td>TSO</td></tr>
<tr><td colspan="4">Who guarantees the investment?</td></tr>
<tr><td>Offshore Connection Point</td><td rowspan="3">Generator</td><td rowspan="4">No financial guarantees required from generator.
4 Criteria have to be met by generator to show commitment.</td><td rowspan="4">All elements: financial guarantees required from generator.</td></tr>
<tr><td>Offshore Transmission System</td></tr>
<tr><td>Onshore Connection Point</td></tr>
<tr><td>Onshore Transmission System</td><td>None at moment. Proposed that 50% guaranteed by Generator (as “wider” element of onshore connection)</td></tr>
</table>

<table>
<tr><th></th><th>GB</th><th>Germany</th><th>Denmark</th></tr>
<tr><td colspan="4">Who pays charges?</td></tr>
<tr><td>Offshore Connection Point</td><td rowspan="3">Generator</td><td>Generator</td><td>Generator</td></tr>
<tr><td>Offshore TNUoS</td><td rowspan="3">Demand customers</td><td rowspan="3">Split between Generator (2-5%) and Demand (95-98%) customers</td></tr>
<tr><td>Onshore Connection</td></tr>
<tr><td>Onshore TNUoS</td><td>Split between Generator (27%) and Demand (73%)</td></tr>
<tr><td colspan="4">Structure of charges</td></tr>
<tr><td></td><td>Locational, (for OWF includes. offshore TNUoS as a part of onshore TNUoS)</td><td>Locational zonal with no difference between onshore and offshore</td><td>Locational zonal with no difference between onshore and offshore</td></tr>
</table>

6.1.7. Consenting process

There is currently a “one stop shop” approach in all three countries, meaning that the consenting process is streamlined with one organisation managing the different authorisations, consents or licences required. In GB, the transmission and generation aspects are licensed separately. However the consenting process is increasingly being combined with the transmission infrastructure which is considered as associated development of the generator station and consented through the same development consent order. In Germany and Denmark, the TSO is responsible for obtaining the consent for the transmission infrastructure. In both countries this is done in consultation with the regulator (DEA in Denmark and Federal Network Agency in Germany). In Germany, the TSO may decide to oversize the platform in anticipation of future projects; however separate consent will be required for each additional cable. Figure 16 provides overview of the consenting process in the key countries; see Appendix C for further details.

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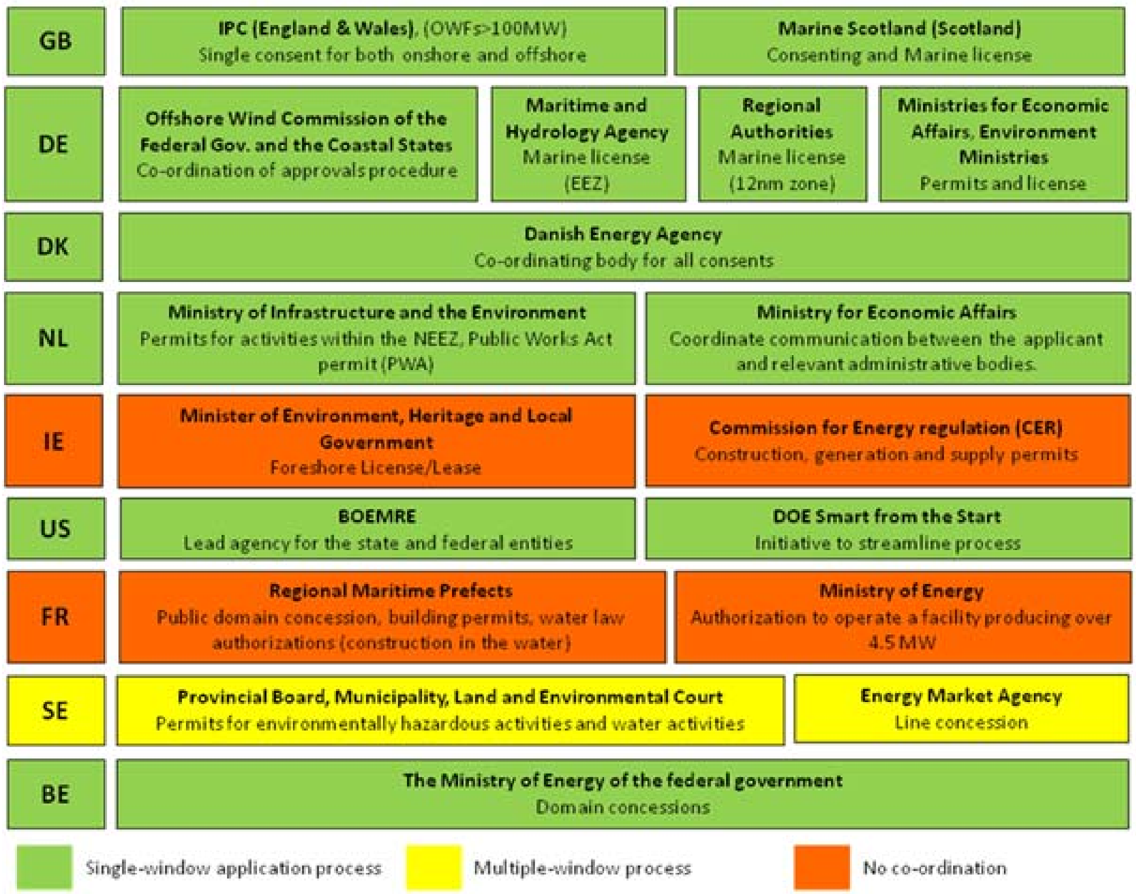

- **Figure 16 Consenting Process**

6.1.8. Project timelines

The timelines for the existing projects in GB, Germany and Denmark are presented on the same plot for comparison. In addition to illustrating the project timelines for each country, the plot also aims to present the timelines for the transmission infrastructure in each project.

Often in Germany, the construction of the export cable commences prior to the start of the OWF construction and thus the offshore transmission system is in place long before the OWF is operational. The advantage of this approach is that as the wind turbines can be connected to the network one by one as they are being built and export power to the onshore transmission system[43].

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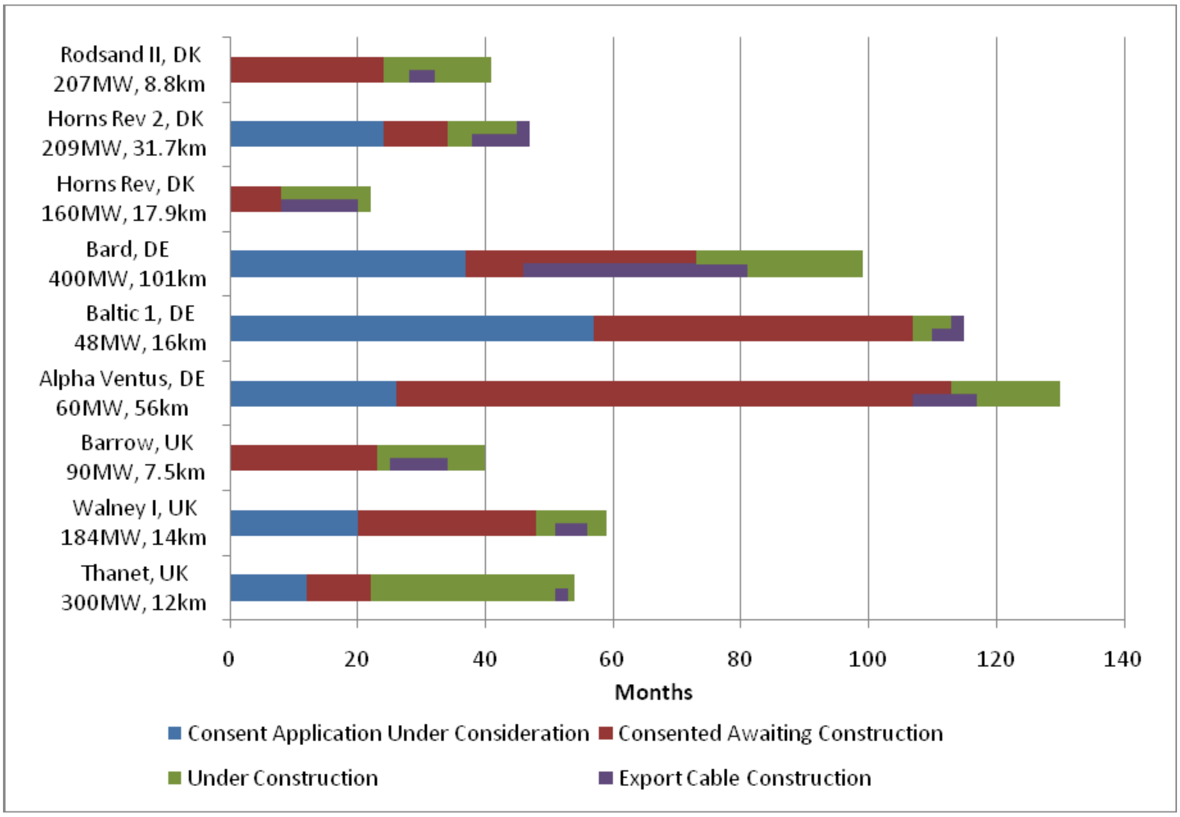
[43] 16 out of planned 80 wind turbines at BARD wind farm are currently connected to the network and producing power.

The drawback is a risk of transmission assets being stranded. The one exception is the Baltic 1 project where the export connection was only delivered after a 3 month delay caused by the cable manufacturer.

Although Denmark and GB operate with entirely different offshore electricity transmission regulatory regimes, the construction of the offshore export cable takes place during the OWF construction stage, usually towards the end of the construction period, for both countries.



- **Figure 17 Project timelines**

6.2. Netherlands, USA, Ireland, France

At present, the Netherlands, USA, Republic of Ireland and France do not have an existing offshore electricity transmission regime or coordination for transmission development offshore wind projects. However there is evidence that these countries are undertaking certain steps towards a coordinated approach. Coordination elements for these countries have been highlighted in the "Country by Country Overview" in Section 5 and summarised below. Additional information is also available in the detailed country overviews, Appendix A.

- In the Netherlands, if TenneT (the TSO) is made responsible for the design, construction and operation of the offshore transmission system, they are likely to take a similar approach to Germany and use collective connections, where cost efficient, rather than project by project connections (i.e. point to point).
- In the USA, there is a relatively developed, though barely tested, system for leasing the sea bed and approving offshore wind which is led by BOEMRE. BOEMRE is responsible for the overseeing of the safe and environmentally responsible development of energy and minerals offshore. Sole jurisdiction for offshore wind rests with BOEMRE.
- The first backbone project (Atlantic Wind Connection) has also been proposed in the USA, backed by strong financial sponsors. The project will serve as a number of nodes that the OWF developers may use as offshore connection points. The backbone will be tied into the strongest, highest capacity areas of the onshore grid to minimize reinforcements. Notably this project has taken the first step in submitting a right of way application to BOEMRE.
- In Ireland, a Group Processing Approach exists and hence, should the interest for large scale offshore development increase, there is a process in place that would allow for collective and interconnected offshore transmission solutions in a similar manner to onshore developments. However there are currently other barriers hindering offshore wind power development in the country.
- In June 2011 EirGrid also released the Executive Summary of the Offshore Grid Connection Study. Some holistic views have been expressed for the future development of offshore transmission systems in Ireland by 2020. The study is to be released shortly.
- In France, the first tender for development rights of five OWFs was held in June 2011 and the decision is expected to follow within one year. RTE will be responsible for the design, construction, ownership and operation of the offshore transmission system for these OWFs. The cost for the connections will be recovered from the generators via annual connection charges. The costs of wider network reinforcements will be paid by demand customers via the transmission tariffs. RTE is currently involved in discussions regarding the collective connections for the future OWFs.

6.3. Belgium, Sweden, China

The developers in Belgium, Sweden and China are currently responsible for construction of the transmission assets between the OWFs and the shore and there does not seem to be plans in the foreseeable future to change that arrangement. The generators in Belgium and China also operate their own transmission assets, but in Sweden once constructed transmission assets should be handed over to transmission concession holder (see below).

The existing Belgian transmission system has limited access to the grid, thus creating constraints for OWF connections. In particular, the Belgian transmission grid had been designed to transport electricity from large centralised plants and, until now, there had been no real need for major transport of energy to and from the coastal areas of Belgium. Additionally there is limited space for OWF developments arising from various conflicting activities at sea, i.e. shipping routes, pipes and cables, nature reserves, naval exercise areas and fishing. Nonetheless there is currently some sharing of costs offshore of the offshore transmission cable. The TSO's contribution to the offshore transmission system costs for OWFs is financed by a surcharge applied to the transmission tariffs levied on demand customers.

In Sweden the incentives for offshore wind power are currently lower compared to other countries. There are currently no projects under construction or in pre-construction phase. Interestingly there should be ownership separation between generator assets and transmission infrastructure for any onshore or offshore generator connected to the transmission or regional network via a dedicated line (grid). Hence this regime has some similarity to the OFTO regime, though there is no competitive tendering process for OFTO appointment. Unlike the GB regime, the Swedish national TSO will only have contractual agreements with the line concession holder (who will be regarded as the user of the transmission system). The relationship between the line concession owner and generator owner is not covered in detail in any of the reviewed documents though it is likely that the generator will develop the offshore transmission system while maintaining business separation between both generation and transmission entities.

China is in the very early stage of offshore wind power development. The offshore transmission system is currently being designed, constructed, owned and operated by OWF developers.

7. Observations and Conclusions

From the country by country overview there is no real evidence to date that coordination has been attempted or justified. Under both TSO led and market led offshore electricity transmission regulatory regimes all existing OWF connections have been delivered as “point to point” connections. There is only one project currently under construction (in Germany) and just a few projects proposed employing coordinated designs (in Germany, Denmark, GB and USA)[44].

From the comparative assessment of the offshore electricity transmission regulatory regimes in different countries two broad offshore transmission regimes were identified:

- the TSO-led approach where one body (national TSO) is responsible for the design, construction and operation of the entire offshore transmission system; and
- the market-led approach where a separate body is responsible for the offshore transmission system for one or several projects.

The TSO-led approach is employed by Denmark and Germany (and France in the future) where the TSO is responsible for planning, construction and operation of the offshore transmission. The market-led approach is employed by GB and Sweden[45], and countries with generator built/owned/operated offshore transmission systems.

From the comparative analysis the following observations were made:

<u>Transmission assets classification, ownership, O&M</u>

- There is no distinction between the classification of offshore and onshore transmission assets in all studied countries apart from GB and Germany.
- Ownership of the offshore transmission assets lies with: the national TSO for the countries employing the TSO-led approach;
- In the market-led approach ownership of the offshore transmission assets lays with a dedicated TAO in GB, Sweden and possibly in Ireland; and the offshore generator in other countries.

44 See Deliverable 2 report for project details

45 Note that in GB and Sweden the offshore transmission and generation are unbundled. However (as opposed to the TSO-led approach) each project might have its own separate transmission asset owner and operator.

Offshore transmission system planning

- The overall offshore transmission system design only exists in countries with the TSO-led approach, though this is not yet the case for France which is still in the early stages of offshore development.
- There are no standards for offshore transmission assets in any of the studied countries though, for the countries employing a TSO-led approach, there is a tendency to use a standard “building block” when developing the connections.

Connection process

- The connection process is initiated by the generator for all the studied countries.
- Shorter timelines for processing of connection applications are set in the countries with the TSO-led approach. The timelines for construction of associated transmission infrastructure are also fixed.
- Note however that from the existing projects it is not conclusive which of the two broad offshore electricity transmission regulatory regimes delivers faster connections. Though the timelines are inherently dependant on the offshore electricity transmission regulatory regime there were other factors contributing to connection of the existing OWFs as e.g. distance to shore, water depth etc.
- In the countries with the TSO-led approach, theoretically, there are better opportunities for coordination between the offshore projects and onshore grid entry point as network development is designed, constructed and operated in a holistic manner.

Shared assets, anticipatory investment and oversizing

- There are no shared assets between the projects currently and no clear process in place to support future transmission asset sharing between the projects anywhere, except for in Germany. Mainly where sharing of transmission assets is discussed it is assumed that some contractual agreement will be reached between the stakeholders.
- None of the regimes, except for the one in Germany, has provisions (risk sharing mechanism between offshore generators and consumers) for anticipatory investment or oversizing. In Germany there is a provision for oversized collective connections or even collective connections with maximum technically possible transmission capacity where deemed efficient. The construction of such oversized transmission systems has to be backed up by at least one OWF, having fulfilled the 4 connection criteria, and the others in the vicinity holding planning permits and consents.
- Anticipatory investment in onshore transmission system reinforcements to accommodate future offshore wind development exists under both market-led and TSO-led approaches.

User commitment, financial security, transmission tariffs

- For countries with a TSO-led approach, the TSO funds the transmission infrastructure. In Denmark, financial guarantees are required from the generator while in Germany certain criteria, including availability of finances, have to be met by the generator to show commitment.
- With the market-led approach, various levels of user commitment and financial guarantees are involved.
- For countries employing a TSO-led approach, the costs of the offshore transmission system and associated onshore network reinforcements are levied on the demand customers. In the countries with a market-led approach, the costs for the offshore transmission system are levied on the generators through the TNUoS tariffs. The costs of the associated onshore network reinforcements are levied on the generators or/and demand customers.

Consenting process

- Consenting for the offshore transmission system is the responsibility of the TSO in the countries using the TSO-led approach. Depending on the country, consenting through a market-led approach is the responsibility of the generator or TAO.
- A “one stop shop” approach for consenting exists in the countries with a developed offshore electricity transmission regulatory regime and this facilitates the streamlining of the projects.
- For all studied countries except GB, there is no specific procedure in place to allow for the splitting or transfer of consents while ultimate owner is not known.
- Germany is the only country for which consents for an oversized platform may currently be granted. However consent for additional cables needs to be obtained separately, according to the present requirements for capacity.

The tables below summarise the results of comparative analysis by presenting the main aspects of the comparative matrix.

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▪ **Table 13 Overview table for GB, Germany and Denmark**

	GB	DE	DK
Is there an overall grid plan?	No (but NETSO role has been extended offshore to ensure coherence)	Yes	Yes
Who is producing the overall grid plan?	N/A	TSO	TSO
Does the overall grid plan include inter-project connections?	N/A	Yes	No
Does the overall grid plan include international connections?	N/A	Yes	Yes
Does the overall grid plan consider reinf. onshore?	N/A	Yes	Yes
Who operates and maintains the transm. assets?	Generator or OFTO	TSO	TSO
Is there standardisation of offshore transmission assets?	No	Yes	No (but standard project sizes)
Who is responsible for construction of offshore transmission system?	Generator or OFTO	TSO	TSO
Are there current/future plans to trade renewable energy with other countries?	No	Yes	Yes
Is there the coordination between the individual wind farm offshore transmission systems?	Proposed	Yes	No
Who is responsible for carrying out the pre-construction works?	Generator or OFTO	Generator and TSO	TSO
Are there any anticipatory investments?	Yes onshore and potential offshore but no development yet	Onshore grid reinf. in anticipation of OWF developments.	No
Is oversizing or other arrangements in place?	There are provisions for some oversizing	There are provisions for oversizing	No
Does transmission charging differ onshore and offshore?	Yes	No	No
Are the transmission connection charges paid by generator?	Shallow	Shallow	Shallow
Who pays transmission charges at the onshore connection point?	Generator	All demand customers (via TNUoS)	All demand customers (via TNUoS)
Is there one body coordinating consenting process?	Yes	Yes	Yes

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- **Table 14 Overview table for Netherlands, Ireland, USA and France**

	NL	IE	US	FR
Is there an overall grid plan?	No	No	No	No
Who operates and maintains the transmission assets?	Generator (currently), TSO (expected)	Generator or TSO	Generator or SO	TSO
Is there standardisation of the transmission assets?	No	No	No	No
Who is responsible for construction of offshore transmission system?	Generator (currently), TSO (expected)	Generator	Generator or TAO	TSO
Are there current/future plans to trade renewable energy with other countries?	No	No	No	No
Is there the coordination between the individual wind farm offshore transmission systems?	No	Possible (with Group Processing Approach)	Proposed	Under discussion
Who is responsible for carrying out the pre-construction works?	Generator	Generator	Generator or TAO	TSO
Are there any anticipatory investments?	No	No	Planned	Under discussion
Is oversizing or other arrangements in place?	No	No	Planned	No
Does transmission charging differs onshore and offshore?	No	No	N/A	No
Are the transmission connection charges paid by generator?	Shallow	Shallow	Shallow	Shallow
Who pays transmission charges at the onshore connection point?	Generator	Generator		Generator
Is there one body coordinating the consenting process?	Yes	No	Yes	No

▪ **Table 15 Overview table for Belgium, Sweden and China**

	BE	SE	CN
Is there an overall grid plan?	No	No	No
Who operates and maintains the transmission assets?	Generator	TAO	Generator
Is there standardisation of the transmission assets?	No	No	No
Who is responsible for construction of the offshore transmission system?	Generator	TAO	Generator
Are there current/future plans to trade renewable energy with other countries?	No	No	No
Is there the coordination between the individual wind farm offshore transmission systems?	No	No	No
Who is responsible for carrying out the pre-construction works?	Generator	Generator or TAO	Generator
Are there any anticipatory investments?	No	No	No
Is oversizing or other arrangements in place?	No	No	No
Does transmission charging differ onshore and offshore?	No	No	No
Are transmission connection charges paid by the generator?	Shallow	Deep	Shallow
Who pays for transmission charges at the onshore connection point?	Demand customers (via TNUoS)	Locational levied both on generation (30%) and demand (70%)	Generator
Is there one body coordinating the consenting process?	Yes	Yes, for all but line concession	N/A

Appendix A Detailed Country by Country Overview

A.1 Great Britain

There is currently 1,525MW of operational offshore wind in GB, with 2,050MW under construction, nearly 1,627MW approved and another 1,960MW submitted consent applications.

The seabed within UK Territorial Waters, and the rights to exploit resources throughout the UK EEZ, is controlled by TCE. TCE has invited bids for leasing the seabed to OWF developers via a series of tendering rounds [12].

In addition to existing plans and extensions from Rounds 1 and 2, TCE has tendered the development rights for up to 32,000MW of offshore wind generation under Round 3. In total, there is almost 50,000MW of capacity that is either subject to an agreement to lease (including Scottish Territorial Waters) or has already been leased. For Rounds 1 and 2, TCE granted lease options to provide some certainty to the developers while they carried out the site investigations. Once all the necessary statutory consents have been obtained by the developer, TCE can then grant a site lease for a development. For the largest of the Round 2 projects, the full term lease is for fifty years, including decommissioning.

Nine offshore development zones were identified for Round 3. Each Round 3 development zone will be developed by TCE and a partner consortium. One consortium for each offshore wind development zone was selected through a competitive tender process. The consortia will work with TCE to identify suitable OWF sites within each zone and thereafter focus on addressing delivery of specific sites. TCE will co-invest (up to 50% of pre-consent development costs) with the contracted consortia in the development programme up to the point of achieving consent for the OWFs. Thereafter involvement of TCE will end, leaving the zone developer to manage construction and operational activities.

In 2010, the UK signed a Memorandum of Understanding alongside Belgium, Denmark, France, Ireland, Luxembourg, Norway, Sweden and Germany, on the North Seas Countries' Offshore Grid Initiative. Although non-binding, the aim of the initiative is to identify and tackle barriers to a more coordinated development of offshore grids thus facilitating investment in such grids and helping the countries involved meet their decarbonisation objectives. It sets out a two year work programme which aims to analyse grid configuration and integration, market and regulatory issues and planning and authorisation procedures.

A.1.1 Transmission assets classification, ownership and O&M

The high voltage transmission system in GB is operated by NGET. NGET also owns the transmission infrastructure in England and Wales. Onshore transmission voltages are considered to be 275 and 400kV in England and Wales, and 132kV and above in Scotland.

How the offshore transmission assets are classified

In GB, undertaking offshore transmission is a prohibited activity for which either a licence or an exemption is required. DECC has put in place a legal structure, which amends various definitions relating to offshore transmission, to ensure that all lines conveying electricity generated offshore at or above 132kV in internal waters, territorial waters and/or the Renewable Energy Zone (REZ) are regulated under the offshore electricity transmission regulatory regime.

Under the offshore electricity transmission regulatory regime, which is currently partially commenced, any electric line operating up to and including 132kV in England and Wales (and up to but not including 132kV in Scotland) that is in territorial waters, is defined as distribution and exempt from any licensing regime under the Class Exemptions Order 2001 for offshore distribution until transfer of assets to an OFTO, and classified as transmission thereafter. This has ensured flexibility in asset transfer and helped to ensure full operation of any transitional project assets, as the new provisions apply to generator built assets only after these are transferred to an OFTO.

Ownership of the offshore transmission assets

Qualifying companies will bid to become the OFTO for a particular offshore transmission system through a competitive tender process. The OFTO’s revenue will predominately consist of the 20 year revenue stream and this is determined by the bid, during the tender process, which is based on the cost submissions for financing, designing/constructing (if applicable), operating, maintaining and decommissioning of the transmission assets. The OFTOs will receive their regulated revenue stream payments via NGET. NGET will calculate and levy the charges payable by the offshore generator for the transmission service.

Construction of the offshore transmission system

The OFTO regime came in to effect on June 2010 with a transition process (i.e. a period to allow developers with existing offshore projects to adapt to the new connection arrangements) taking place from June 2009.

Under the enduring regime generators will be able to choose to construct the transmission system for the project, the "generator build" approach [13], or to opt for the OFTO to do so. In the latter case “early” OFTO appointment is possible, where the OFTO will become responsible for planning, design, consenting, construction and operation of the transmission system. Alternatively “late” OFTO appointment is possible once all necessary consents are secured.

A.1.2 Offshore transmission planning

There is no overall offshore transmission system plan in GB, though the National Electricity Transmission System Operator (NETSO) role has been extended offshore to ensure coherence. Although statements are in place to provide information on the offshore design, this is not in the shape of a blueprint. To facilitate the coordinated development of the onshore and offshore transmission system, there is a new license obligation requiring the NETSO to develop an annual Offshore Development Information Statement (ODIS). The statement includes a wide range of information relating to possible development of both the offshore and onshore transmission systems: generation scenarios, applicable technology, offshore transmission system design and onshore transmission coordination. Since the publication of the 2010 Statement, NETSO has undertaken a conceptual design study into the development of an integrated offshore transmission system in addition to point-to-point connections.

Additionally steps have been taken to investigate onshore transmission system reinforcements required to meet 2020 renewable targets. The Electricity Networks Strategy Group[46] (ENSG) (a cross industry group jointly chaired by the DECC and Ofgem) has, among other tasks, produced the “Strategic Reinforcements Required to Facilitate Connection of the Generation Mix to the GB Transmission Networks by 2020” report[47]. The reinforcements identified by this report are based on a range of scenarios that examine the potential transmission investments associated with the connection of large volumes of onshore and offshore wind generation, required to meet the 2020 renewable targets. To ensure that the critical investments needed to facilitate the achievement of the 2020 targets are not delayed as a result of regulatory or funding considerations, Ofgem through the Transmission Access Review has developed the Enhanced Transmission Investment Incentives (TII) which consider application for funding for both pre-construction works and construction works in a staged manner, under the current transmission price control.

At the end of September 2011 the TCE and National Grid published the Offshore Transmission Network Feasibility Study[48] to identify and assess the feasibility, benefits and challenges of adopting a more coordinated approach to the development of the offshore transmission system. The coordinated design presented in that study is based on the installation of high voltage multi-user assets that interconnect the offshore platforms and generation projects to form an offshore network that is fully integrated with onshore transmission system requirements. This conceptual design highlights how the volume of assets installed offshore could be reduced whilst the need for onshore reinforcement is minimised. The designs present an illustrative coordinated transmission design approach and have been developed to allow a comparison between the potential design options.

[46]Electricity Network Strategy Group: Uwww.ensg.gov.ukU

[47] Note this was published in 2009 and the report is currently being updated.

[48] Note that due to the time of publication the Offshore Transmission Network Feasibility Study is only mentioned here but not considered in detail in this report.

Ofgem and DECC, recognising the importance of developing a coordinated offshore and onshore transmission network, are also jointly undertaking the OTCP to consider whether any additional measures will be required to deliver coordinated networks through the competitive offshore electricity transmission regime and, if so, how these measures might work in practice.

A.1.3 Connection Process

The transmission grid connection application process is initiated by the developer submitting a Connection Application to NGET. NGET will have 3 months to issues a “Stage 1” offer to the developer. The construction programme in the offer will be based on the date of entry into the tender process identified by the developer in their application and the assumed date of appointment of an OFTO deriving from this. The developer has 3 months to accept or reject the offer.

Once Ofgem has appointed an OFTO and the tender process is completed (approximately 1 year[49]), NGET will submit an application to the OFTO for a Transmission Owner Construction Offer (TOCO) for the offshore works associated with the successful bid. NGET will then incorporate the terms of these works into a “Stage 2” offer to the generator within 3 month. The developer has 3 month to accept or reject this offer. This process is designed to enable the works, both onshore and offshore, in the revised offer to progress through to commissioning, completion and operation of the OWF.

The Further Consultation on the Enduring Regulatory Regime proposes that, for the case of a generator built approach, the two stages in the connection application process should also be implemented to ensure appropriate contractual interfaces are put in place. However it is anticipated that the scope of the connection offer, required at each stage, will be substantially different for the generator built model compared to the OFTO built model as more information about the offshore transmission system may be available at the initial stage.

A.1.4 Shared transmission assets, anticipatory investment and oversizing

Ofgem, under the Transmission Access Review, has developed an Enhanced TII to ensure that the critical investments for GB’s onshore transmission system reinforcement, needed to facilitate the achievement of the 2020 targets as identified by the ENSG study, are not delayed as a result of regulatory or funding considerations. The Enhanced TII considers applications for funding both pre-construction works and construction works in a staged manner under the current transmission price control. Note that not all investments that have been identified by the ENSG will necessarily go ahead.

The level of capacity to be tendered in the OFTO process is defined by the level of financially backed capacity required by the generator in its connection offer. However Ofgem recognises that

[49] So far only 2 OFTOs appointed. It is expected that the process will speed up over time.

decisions, over the level of capacity, to construct are ultimately matters for the OFTO and offshore generators to influence and manage through financial commitments. Therefore it is believed that Ofgem would agree to offshore transmission system designs that reflect expectations of future demand for capacity if those issues could be resolved on a bilateral basis and are financially backed through the connection agreement, [17].

Ofgem would consider whether initial offshore transmission assets over-sizing was economically and efficiently incurred and so eligible to be included within the OFTO transfer value. In addition the incremental capacity incentive provides scope for an expansion of up to 20% of bid costs once the project is operational.

The "Further Consultation on the Enduring Regulatory Regime" by DECC and Ofgem in August 2010, [10], states that in the future NETSO may propose, in the connection offer, a joint connection solution for several projects if deemed more efficient. In this case Ofgem would expect the parties to reach a contractual agreement which would allow the overall solution to be delivered in accordance with NETSO's planning assumption requirements.

There is no clearly defined process for considering anticipatory investment on offshore transmission systems yet. However anticipatory investment on offshore transmission systems is currently discussed in the context of the OTCP.

A.1.5 User commitment/financial security and transmission charges

There is a requirement to cover the offshore transmission system costs, which if not 100% directly funded by the generator, has an ongoing commitment requirement through either a cash deposit or some form of performance bond/letter of credit.

Under the existing regime companies that request a connection are expected to provide security from the date of the request until commissioning of their OWF and commencement of payment of TNUoS charges. Two approaches to setting the level of commitment exist:

- Final Sums Liabilities (FSL), where the generator protects the OFTO against the risk of stranding through an increasing commitment as investment is undertaken. Wider investment requirements may also be captured in these FSLs which has led to uncertainty about actual exposure; and
- Interim Generic User Commitment Methodology (IGUCM), to address the concerns of uncertainty inherent in FSLs this approach used multiples of the annual generator TNUoS charge as a proxy for investment costs (with the multiple set at 10). The exposure to this cancellation charge increases each year by 25% from the trigger date until commissioning (expected to be four years after the trigger date). Note this is only available for the onshore reinforcements associated with an offshore project. [15]

Both approaches are time-bound, with the deadline for a new approach to be introduced in spring 2012 (the original deadline of 2011 was extended).

The level of security required depends on the credit-rating of the developer. If the rating is acceptable then no security is required. However, if no rating is provided or the company loses the required level of rating then security must be provided either through some form of guarantee/performance bond or through a cash deposit.

NGET has proposed an amendment to the commitment system for onshore connections (CMP192), replace current arrangement after spring 2012, which would make the commitment:

- for pre-commissioning;
  - cancellation would incur costs for both local and wider activities.
- for post-commissioning:
  - if more than four years notice of termination is provided then there is no charge; and
  - if less than four years there is a cancellation charge based on wider costs (with the proportion of the cancellation charge levied being higher the shorter the notice being given).

For pre-commissioning users the charges are as follow:

- prior to the trigger date (four years before the connection is required) there is a maximum charge of GBP 3/kW (which starts at GBP 1/kW and increases by GBP 1/kW per year to the cap) – 100% guarantee is required at this point;
- from the trigger date a liability based on proportions of local and wider costs[50] are incorporated where the proportions are affected by:
  - ability to re-use assets;
  - sharing of wider costs between demand and generation; and
  - any degree of sharing.

Security/guarantees are required as follows:

- from trigger date to key consents being achieved – 42% of cancellation charge; and
- after key consents being achieved – 10% of cancellation charge.

No security would be required from post-commissioning generators given that physical assets exist.

[50] The wider costs are the transmission costs incurred to strengthen the network and these are based on a share of annual capex while the local costs are user specific costs.

The current TNUoS charging methodology provides wider access charges which vary by location, reflecting the costs that the users (generation and demand) impose on the grid. TNUoS charges are currently split into two component parts; a locational element and a residual element.

The locational element covers all investments in "locational" assets which provide grid access. The locational charging signal produced by NGET's TNUoS charging methodology reflects the impact that transmission users at different geographical locations have on transmission costs. To provide greater stability, and for administrative simplicity, tariffs are grouped into pre-determined geographic "zones" and a zonal average is calculated. In the case of generators, the locational element of transmission charges reflects the zonal average long-run forward-looking costs of connecting an incremental mega watt (MW) of generation at a given point on the transmission network. The same principles apply to demand customers.

However, the locational element of the TNUoS charge does not recover the total amount of revenue allowed to the companies. This is because:

- the transmission network is not always optimally sized; and
- the network comprises of "non-locational" assets, such as substations, that contribute to overall security.

Therefore once the locational tariff has been calculated, a non-locational correction factor – generally called a residual charge - is applied to the tariffs to recover the total allowed revenue of the transmission licences.

Generator TNUoS tariffs are made up of four components. The sum of these forms the total TNUoS tariff for a generator. The tariff components are:

1) **Wider Locational:** A locational zonal tariff that reflects the cost of providing incremental capacity on the onshore transmission network.
2) **Local Circuit:** A locational nodal tariff that reflects the cost of the transmission circuits from the point of connection to the main interconnected transmission system.
3) **Local Substation:** A locational nodal tariff that reflects the cost of the transmission substation that the generator is connected to.
4) **Wider Residual:** A non-locational tariff that ensures the correct revenue is recovered from generation users.

All directly connected generation will be levied with a "Local" TNUoS tariff. This generation TNUoS tariff reflects the costs of the infrastructure assets that are local to the generator as opposed to the assets in the deeper transmission infrastructure known as the Main Interconnected Transmission System (MITS). For a generator, not directly connected to a MITS substation, the Local TNUoS tariff will comprise of two elements: (i) an element representing the costs of the circuit linking the local substation to the nearest MITS substation, and (ii) an element reflecting the cost of the first transmission substation that the generator is connected to. Generators directly connected to the MITS will be subject to a Local TNUOS tariff consisting only of the substation element targeting the incremental asset cost of the generator's local transmission substation (i.e. it will not have a local circuit element of the TNUoS charge).

Offshore Local TNUoS tariffs have the same structure as onshore Local tariffs, i.e. contain a substation and circuit element. However, offshore Local tariffs are based on recovering the project specific costs of the offshore transmission system. Onshore, the local circuit and local substation elements are derived from average generic cost analysis for the relevant design and type of circuit and local infrastructure substation assets which are required for each generation connection.

The current regime presents incentives to minimise the length of the offshore transmission system, encouraging the onshore connection point to be located at the nearest point onshore without accounting for any impact on the system. The regime incentivises for an onshore connection point located as close to the shore as possible, even if a more suitable connection exists further inland, as this reduces the connection distance and thus the cost of the assets. Additionally international interconnectors are exempt from TNUoS entry charges and therefore there is also an incentive to create an international interconnection. The transmission charging regime is currently under review.

NGET is obliged under their license conditions to establish and keep under review appropriate transmission charging methodologies for the electricity transmission system.

A.1.6 Consenting process

Achieving planning permission for OWFs in GB has until recently required developers to obtain multiple permits and licences. Transmission and generation aspects are still licensed separately. However the consenting process is becoming increasingly amalgamated. Transmission infrastructure is generally considered in association with development of the generator and consented with the same development consent order. There are differences between the current consenting regimes in England & Wales, Scotland and Northern Ireland.

The Planning Act 2008 has sought to streamline consenting process by establishing the Infrastructure Planning Commission (IPC), which is responsible for the issuance of a single consent for Nationally Significant Projects (projects greater than 100MW) in England and Wales. The actual application process in England and Wales takes about 13 months, although the process is 'front-loaded' with an emphasis on the developer undertaking all necessary consultation activities before the application is submitted. Applicants in England can include onshore elements requiring planning permission (e.g. substations) and offshore elements requiring a marine licence. In Wales separate applications to the local authority will be required to obtain planning permits required for associated offshore development and to obtain a marine licence within the Welsh territorial waters. All major offshore proposals are subject to an EIA. Other consents may be required on a project by project basis. Below the consents that were required for the world's largest OWF Thanet (300MW) are listed as an example:

- Consent under section 36 of the Electricity Act 1989 to construct and operate the OWF, including all ancillary infrastructure.
- Licence under section 5 of the Food and Environment Protection Act 1985 to deposit materials such as the turbine foundations and the buried cables, on the seabed. The Department for Environment, Food and Rural Affairs (Defra), which takes responsibility for protecting marine ecosystems, made the decision on this.
- Consent under section 34 of the Coast Protection Act 1949 in order to make provision for the safety of navigation in relation to the export cables.
- Planning permission required under section 90 of the Town and Country Planning Act 1990, sought as part of the section 36 application, for the onshore elements of the works.
- The extinguishment of public rights of navigation was also requested under the Energy Act 2004 for the areas of seabed directly covered by the offshore structures comprising of the turbines, offshore substation and anemometry mast. Safety Zones of up to 500m around all structures were requested, which would limit the activities of certain vessels within this area. This was to ensure the safety of life at sea.

The UK Government has announced its intention to change the planning consents process for major infrastructure projects as follows:

- a Major Infrastructure Planning Unit would be set up within the Planning Inspectorate to examine planning applications, and would replace the Infrastructure Planning Commission;
- responsibility for major infrastructure planning decisions would return to Ministers; and
- the Infrastructure Planning Commission would continue in its present role until it is dismantled.

In Scotland consents for offshore generating stations in Scottish waters are awarded by the Scottish ministry. Marine Scotland has the responsibility of processing new offshore development consent applications and marine licenses for the offshore generating stations. The application process takes approximately 9 months. Applications can include onshore elements requiring permission and can also request that deemed consents be granted alongside the main development consent or applied separately through the planning authority. Similarly to England and Wales a single EIA is most likely.

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A.2 Germany

German OWFs require high investment costs due to the long distances to shore and the depth of the water at the suitable locations. There are currently only two OWFs operational in Germany with total installed capacity of 120MW. However there is approximately 400MW under construction and a further 7,235MW with consents in place.

The large number of projects that are past the consenting stage (i.e. approved) may be attributed to the number of earlier projects that have finally completed the lengthy consenting process (3.3 years on average[51]). Grid connection issues and the responsibility for building an offshore transmission system has long been an open debate and the current arrangements, detailed below, is only in force for a limited period of time. Moreover, from 2015, there will be a regression of 5% per annum on the combined feed-in tariffs and bonuses for new projects going online[22]. The rush to meet these deadlines might also offer an explanation for the large number of approved and planned projects in the pipeline. For a number of sites, conflicting consent applications has been lodged as well, thus slowing down the consenting process. Additionally from the analysis of existing project timelines, there is also a relatively long period between the consent authorization and the start of construction (6.7 years on average[20]). This is due to difficulties in securing the required finances.

In 2010, Germany signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding [10]

A.2.1 Transmission assets classification, ownership and O&M

The high-voltage transmission system in Germany (220/380kV) is owned by four separate companies that are responsible for developing and managing the network in different geographical areas. The part of the grid covering Baltic Sea coastline is owned and operated by 50Hertz. The grid in the central part of Germany, including the North Sea coast, is owned and operated by TenneT.

How the offshore transmission assets are classified

The transmission voltage for offshore networks is 155kV and above.

A.2.2 Offshore transmission planning

Construction and operation of the OWF grid connections is performed by the affiliated companies TenneT Offshore Gmbh and 50Hertz Offshore Gmbh. On behalf of the TSOs, TenneT and 50Hertz, these companies perform the planning and construction of offshore transmission systems. This mainly involves the following tasks:

[51] Averaged for 27 existing, under construction and consented OWF [11]

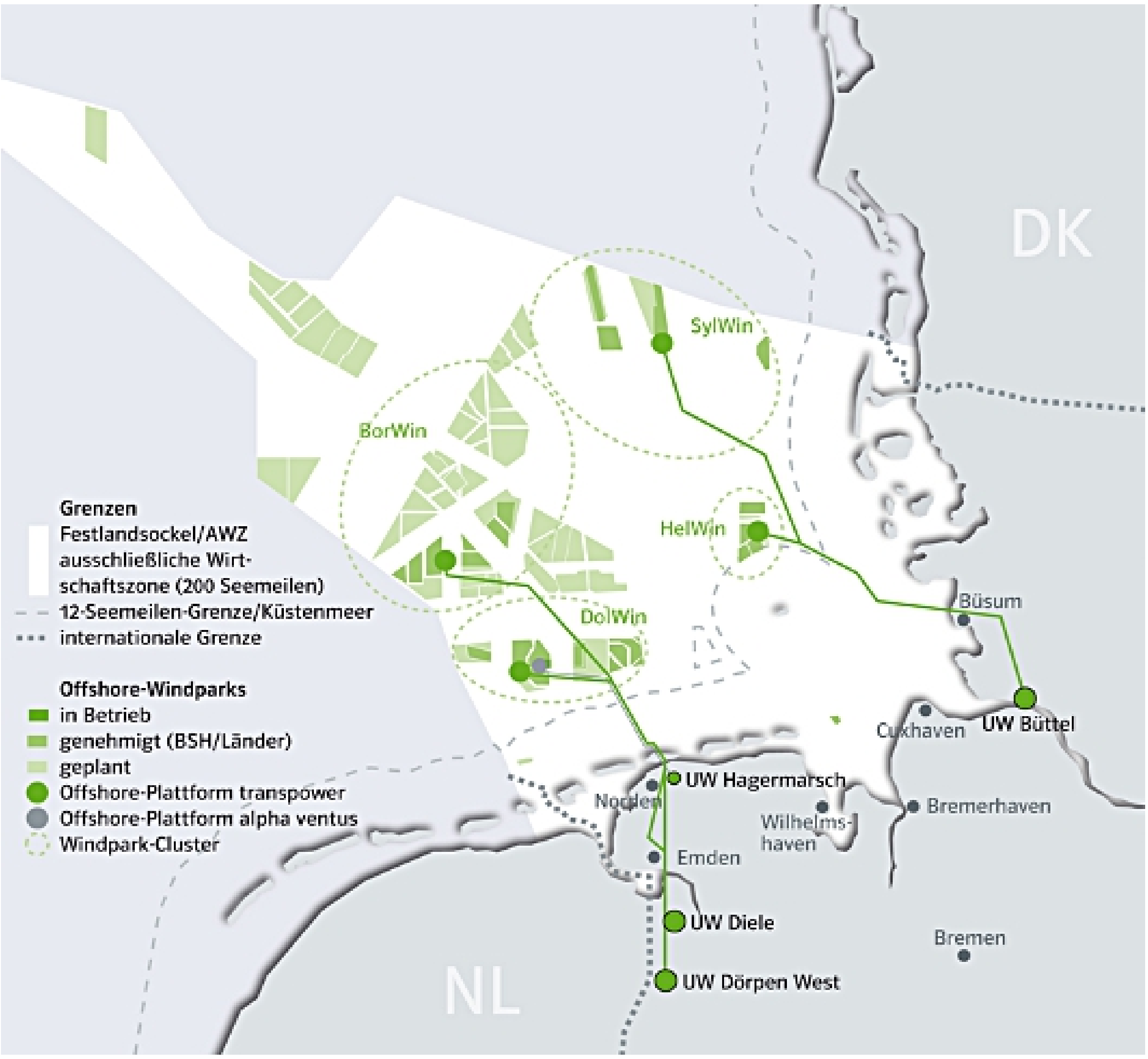
- development of technical concepts for connecting the OWFs;
- continuation or new development of route planning;
- carrying out the legal approval and nature conservation procedures for realisation of the grid connections; and
- putting out to tender, awarding and processing grid connection projects for OWFs

Current and planned grid connections for OWFs are published on the websites of the respective TSO's (50Hertz Offshore and TenneT Offshore), see figures below.

The German transmission network development plans are also a part of the ENTSO-E TYNDP. Similarly to Denmark, since the German TSOs are responsible for planning and developing the connections between future OWFs and the onshore network, connectors for all under construction and approved OWFs are a part of the overall network development plan.

It is also worthwhile mentioning the Kriegers Flak; a triple project (potentially 3x600MW) planned on the EEZ borders of Sweden, Germany and Denmark. According to the feasibility study conducted by the three TSOs involved (50Hertz, Energinet.dk and SvK), it is envisaged that the connections from each OWF to the respective countries will be HVDC, with AC interconnections between the three OWFs. Although SvK, the Swedish grid operator has pulled out due to lack of interest from potential investors in the OWF, the German and Danish projects are still planning to go ahead. Planning for the German Kriegers Flak wind farm (EnBW Baltic 1) has already started. According to the latest information however, the size of the OWF is expected to be 288MW. The transmission capacity of the offshore transmission system will be adjusted accordingly (one AC-cable will be laid between EnBW Baltic 2 and Baltic 1 OWF in a first step). It should be noted however that in Denmark and Germany different feed-in tariffs apply and this issue is yet to be resolved.

Figure 18 View of 50Hertz Offshore for the future OWFs



- **Figure 19 Vision of TenneT for interconnection of the future projects (source TenneT Offshore, Our Projects)**

A series of strategic grid studies have been commissioned by the German Energy Agency, DENA. Steered by representatives of the German Ministry of Economy (the wind energy branch), major utilities and their associations, the studies aim to identify the long-term consequences of an increased share of renewable energy on the electrical system, including the required grid upgrades and extensions. Some of the recommendations of the first DENA study are progressing to the consenting phase. The objective of the Dena Grid Study II, published in November 2010, was to investigate suitable system solutions for the German power supply system (up to 2020 with an outlook to 2025), to fully integrate 30% of renewable energy into the German power grid while guaranteeing the security of supply and taking the effects of the liberalised European energy market into account.

A.2.3 Connection Process

The TSO is obliged to connect OWFs to the grid (section 17(2a) of the Energy Act). The position paper "Positionspapier zur Netzanbindungsverpflichtung" was published by the Federal Network Agency[52] in October 2009 to provide further details on the requirements for receiving the grid connection. The paper sets out the requirements and timelines that the developer must adhere to, in order to achieve connection. In January 2011, the Federal Network Agency issued the Annex to the position paper that further develops the connection procedures. The need for this document was sparked by the first connection experiences, taking into account the limited availability of the offshore transmission routes and recent technological developments. The procedures set out in both of the above documents are summarised below.

The TSO launches a call for tender to connect the offshore wind power projects. Each project is required to meet the following four criteria for connection:

1. Consent or Planning Permit: Developer must deliver a copy of the building consent.
2. Project construction program: covering foundation, establishment of substation at sea, laying down internal OWF cables, installation of WTs, structural and electrical works.
3. Site investigations: full soil investigation of the site including location of each foundation, following the standard "Ground Investigation for OWFs" issued by the Federal Maritime and Hydrology Agency (BSH)[53].
4. Supply contract & Financing: The developer must submit a contract for the supply of turbines (or Binding Reservation Agreement), together with evidence demonstrating the project has fulfilled one of the two following criteria:
   - sufficient finances in place to construct the wind turbines scheduled for construction in the first year of the project; or
   - binding reservation agreements (or full contracts) for the other major components (foundations, transformer platform incl. transformer, cabling of the wind turbines to the substation).

The criteria are set in order to ensure that the projects are developed far enough to justify investment in the offshore transmission system.

The TSO may decide to establish an integrated (collective) solution, if it is more cost efficient than a point-to-point solution.

For the offshore transmission system, the installed capacities of all offshore projects that fulfil three of the four criteria (1,2 and 3/4) by 1st March (of year 0) or 1st September (of year 0) respectively

[52] Known as "Bundesnetzagentur"
[53] Known as "Bundesamt für Seeschifffahrt und Hydrographie"

should be taken into account by the TSO, while deciding the cable dimensions and number of cables. An increase of the installed capacity of the OWF is in principle not possible beyond that time point. If the OWF owner still wishes to increase the installed capacity, then it may only do so if there is "free" capacity left on the dedicated collective connection or it will need to tender for a new connection following the same procedure as before.

Introduction of cut-off dates ensures that the TSOs, who are obliged to provide the offshore transmission system, will not need to continually adapt their plans to varying levels of progress made by individual offshore wind power projects. This also allows the wind power developers/operators to orient their plans to a time schedule that they are familiar with. This procedure benefits all stakeholders and is particularly necessary to render the implementation of efficient collective offshore transmission systems feasible.

At latest, on the 30th April (of year 0) or 31st October (of year 0), the TSO has to start the tender for the considered projects. Conditional grid access assurance is issued for these offshore wind power projects to confirm that their installed capacity is taken into account for the network connection. Grid access will be subject to the fulfilment of the final criteria. This will place the TSO in a position to commence the tender process for the offshore transmission system for the project.

The tender call has to indicate the target dates for the planned commissioning of the connector as well as the planned commissioning of the offshore projects. For the case of a coordinated offshore transmission system, the target date for commissioning the line should be earlier than the OWFs. The bidders can propose a later alternative to the target date. In the tender call, the TSO has to consider the different lot sizes so that at the time of contract award the exact dimension of the offshore transmission assets can be determined. For example, if the coordinated offshore transmission system involves two OWFs with a capacity of 200MW and 300MW, it should be ensured that in the tender design 200MW, 300MW or 500MW variants can be served.

After six months, the offshore transmission assets have to be ordered for all the offshore wind projects that have met all 4 connection criteria[54] and have therefore demonstrated that the project is likely to be implemented. On the 1st September (of year 0), respectively 1st March (of year 1) the TSO has to determine that and unconditional grid access assurance is granted to these offshore projects a month later. Additionally, the annex to the position paper clarifies that for the case where

[54] Previously, generators have had difficulties obtaining financial loans without a connection offer. However the connection offer requires proof of sufficient finances before it is granted. This problem is now resolved by issuing financial loans under the condition that network connection is granted. The TSO will in turn consider this conditional loan as the fulfilment of criteria 4.

an OWF fulfils all 4 connection criteria at once, unconditional connection grid access assurance will be issued following a connection application on the 30th April (of year 0) or 31st October (of year 0), i.e. the “staged” fulfilment of the connection criteria is not a requirement.

Projects with a conditional grid access assurance that have not fulfilled all four criteria in 6 months after the application deadline (1^{st} March or 1^{st} September of year 0); will only be re-considered in the next tender process.

Additionally, the TSO has to make sure that the main offshore substation is sufficiently dimensioned or can be extended, without any unnecessary delay (e.g. modular extension), to connect projects that will be built later in the efficient and economic way. The planning and achievement of a collective offshore transmission system does not oblige the TSO to order the cable and necessary equipment at the same time. The TSO has to find an economic and technical trade off to be able to use efficiently the benefits of oversizing and be able to order parts in the way that suits several implementation schedules.

In general the connection offshore transmission system should be built within 30 months (10th April respectively 30th October of year 3). For OWFs that have fulfilled all 4 connection criteria, it can take 36 months from the issue of the unconditional connection offer. This depends on whether the construction of the dedicated capacity is required for these OWFs or if there is “free” capacity available within the existing or planned (at the time) collective connection.

For all generators in question, once evidence of criteria 1 has been achieved, the TSO should start planning the route and begin the consenting process for the offshore transmission system. The TSO should update the concerned developers about the progress of the consenting process and any delays.

In order to be able to commence construction on the offshore transmission system(s) immediately after all the concerned generators have demonstrated compliance with the four connection criteria, the TSO is required to begin the planning of the offshore transmission system in advance.

The Federal Network Agency requires the TSO and all concerned parties to agree on the detailed implementation schedule for development of the OWFs and the offshore transmission system. This includes the content, timely delivery and responsibilities of the parties.

The discussions of the implementation schedule should begin as early as possible though this usually occurs immediately after the fulfilment of criteria 1 and 2 and the beginning of the site investigation (criteria 3). The implementation schedule should be agreed within 3 months after the fulfilment of the aforementioned criteria.

Each participant is entitled to make adjustments to the implementation timetable as a result of any change in circumstances. The important steps to be included in the implementation schedule are listed in the position paper. The implementation schedule should be submitted to the Federal Network Agency. All parties should immediately be informed about any changing circumstances that might lead to an adjustment of the implementation schedule.

A.2.4 Shared transmission assets, anticipatory investment and oversizing

There is anticipatory investment in terms of onshore network reinforcement that is taking place, based on recommendations of the DENA study, in anticipation of the future offshore wind power development in the North of the country.

Generators are required to meet the four criteria in order to be granted connection to the grid, as explained in the previous section. According to the position paper, the capacity of the collective connection would have been backed up by the installed capacity of the concerned OWFs fulfilling the 4 criteria. However the Annex elaborates further that due to the limited amount of the offshore transmission routes, the TSO may consider oversized collective connections even if only one generator has applied for connection in any ongoing connection round. Other generators in the vicinity, that fulfil criteria 1 (consent or planning permit) but not yet applied for connection, will be considered when deciding the capacity of the collective connection. It is also envisaged that in the future the TSO may chose the collective connections with the highest possible capacity in order to achieve the economy of scale. “Free” capacity on this collective connection will be tendered for on the same dates as connection tenders, (30th April and 31st October each year). The capacity access will be granted to the generators that fulfil all 4 connection criteria, in the following priority order. First priority will be given to the OWFs that are already using the collective connection in question, in case these OWFs wish to expand. The second priority will be given to OWFs that have fulfilled the 4 connection criteria but not yet obtained unconditional connection offer. The third priority will be given to the generators that fulfil 3 out of 4 connection criteria. Understandably the decision, for which OWFs will be granted access to the “free” capacity on the oversized collective connection, will be based on the considerations of geographical location of the OWFs, technical and economic feasibility.

A.2.5 User commitment/financial security and transmission charges

There is no formal financial security/commitment required by the TSO. Instead, generators are required to meet four criteria, discussed above.

The TSO is responsible for funding all offshore transmission asset investments. The Renewables Law requires that the onshore grid extension costs, associated with connecting renewable energy to the grid, are the responsibility of the TSO. The recent Act on the Connection of New Power

Plants[55] designed to encourage more generation development in Germany, stipulates that any "other facilitation costs" incurred by the TSO while setting up the grid offshore transmission system (such as costs associated with transformers or a switchgear bay at the offshore connection point) can no longer be imposed on new connections. A timetable for grid extension measures must also be provided with the threat of sanctions for construction delays. It should be noted that, under this law, a TSO is not permitted to refuse a connection on the basis that it will increase congestion.

Under the Infrastructure Planning Acceleration Act 2006[56] the TSOs are also responsible for covering a proportion of the "shallow" costs associated with extending the transmission line offshore to connect to proposed OWFs that are constructed before the end of 2015. The Act seeks to achieve economies of scale in construction and planning by making the TSOs responsible for the planning and financing of the offshore transmission system. The aim is for the TSOs to adopt a systematic planning approach by "bundling" possible future OWF connections at the planning stage, thereby avoiding point-to-point only connections. The costs of the offshore transmission system will initially be borne by the TSO in the region, but will ultimately be distributed across all four TSOs in Germany.

The costs for the offshore transmission assets for the OWF are recovered through TNUoS tariffs. The tariffs for use of the transmission system in Germany comprise three elements which reflect the costs associated with the use of the grid infrastructure, costs relating to system and balancing services, and costs that reflect losses that occur in transmission. Similarly to the procedures in Denmark, these charges are levied on demand customers and shared throughout all four German TSOs and are zonal in nature.

A.2.6 Consenting process

The BSH is responsible for the approval of offshore wind energy installations when the OWFs are located in the area of the EEZ. In contrast, each single Regional Authorities[57] are responsible for the approval of installations located within the 12 nautical mile perimeter. Typically the Ministries for Economic Affairs and the Environment Ministries (and their respective agencies) are directly involved in the regulation of offshore wind (i.e. permitting and licensing).

In order to coordinate the consenting procedure between the federal states and central government entities, the permanent Offshore Wind Commission of the Federal Government and the Coastal States[58] was set up in 2002 [9].

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[55] Known as "Netzanschlussverordnung – KraftNAV"
[56] Known as "Infrastrukturplanungsbeschleunigungsgesetz"
[57] Known as "Bundeslander"
[58] Known as "Ständiger Ausschuss Offshore Wind der Bundesregierung mit den Küstenländern - StAO-Wind"

A.2.7 Current major projects

- Alpha Ventus, 60MW – Commissioned 2010
- Baltic 1, 48MW – Commissioned 2011
- BARD, 400MW – Partially operational; 15 out of 80 turbines grid connected in July 2011, expected 2012

A.2.8 References

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[2] TenneT TSO, http://www.tennettso.de

[3] 50Hertz Offshore http://www.50hertz-offshore.net

[4] German Energy Agency, Dena Study I, http://www.offshore-wind.de/page/index.php?id=2605&L=1

[5] German Energy Agency, Dena Grid Study II http://www.dena.de/fileadmin/user_upload/Download/Dokumente/Studien___Umfragen/dena_Grid_Study_II_-_final_report.pdf

[6] Federal Network Agency, Positionspapier zur Netzanbindungsverpflichtung, Position paper and Annex, http://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetGas/Sonderthemen/AnbindungOffshoreWindparks/AnbindungOffshoreWindparks_node.html

[7] ENTSO-E Ten Years Network Development plan

[8] 50Hertz, Energinet.dk, SvK, “Kriegers Flak Combined Grid Solution Final Feasibility study” http://www.50hertz-offshore.net/de/file/2010-02-24_Final_Feasibility_Study_Public.pdf Feb. 2010

[9] Offshore-wind.de, webpage with information on offshore wind in Germany, supported and updated by Germany Energy Agency (DENA).

[10] North Seas Countries Offshore Grid Initiative Memorandum of Understanding https://www.entsoe.eu/fileadmin/user_upload/_library/news/MoU_North_Seas_Grid/101203_MoU_of_the_North_Seas_Countries__Offshore_Grid_Initiative.pdf

[11] 4C offshore, Global Offshore Wind Farms Database http://www.4coffshore.com/

A.3 Denmark

In Denmark 868MW of offshore wind power is currently operational, with another 400MW under construction. There are two application routes for a license [4]:

- The invitation by the DEA for bids to tender for pre-specified sites which have been decided by the government based on an EIA and the onshore network access among other considerations. The permissions usually include a “use it or lose it” condition to promote a rapid realization of the OWFs [6]. Energinet.dk is responsible for connecting the OWFs and will also cover the cost of the offshore transmission system from the OWF (including the offshore step up transformer) to the defined OWF grid connection point. The revenue will be subject to a tender negotiation. This was the case for the Horns Rev I and II, Rødsand I and II and will be the case for the upcoming Anholt OWF Projects.
- Open applications for any site are assessed by the DEA and consents are given on a first come first served basis. This is the “open door principle” where the cable connection to shore from the OWF will be borne by the developer (including the step up transformer). The costs of any necessary grid reinforcement are also borne by the developer.

Originally, the industry has planned and recommended to build up the country’s OWF capacity by 200MW each year in order not to reduce the burden on the construction industry. The order of building should be a compromise of the lowest socioeconomic cost and the preference from the grid operator Energinet.dk. A few years after the Action Plan was issued, the TSO recommended building OWFs with a minimum capacity of 400MW to reduce the cost of the offshore transmission system. This advice was followed by the Government for the Djursland/Anholt project.

There is strong co-operation amongst the TSOs of the Nordic countries (Sweden, Finland, Norway and Denmark). They also operate a single market for trading electricity through the Nordpool and the regulators cooperate through NordREG. Subsequently there are no barriers from the electricity market perspective to offshore transmission system development between these countries (e.g. between Denmark and Sweden).

In 2010, Denmark signed the North Seas Countries’ Offshore Grid Initiative Memorandum of Understanding [19] .

The COBRA cable project is a potential international HVDC interconnection between Denmark and the Netherlands. It is envisaged that this would form a part of a North Sea offshore grid and is aimed specifically at promoting and supporting the integration of renewable energy (particularly wind). The scheme has been supported with EUR 86.5M from the EU Economic Recovery Plan and the intention at this stage is to provide a potential direct connection for OWFs to the offshore cable. The international interconnection is scheduled to be operational by 2016 subject to a decision to begin construction in 2012. [12]

A.3.1 Transmission assets classification, ownership and O&M

Energinet.dk owns the 400kV installations and the international interconnections, whereas the 150/132kV installations are owned by the RTC, which make the 150/132kV grids available to Energinet.dk. However, Energinet.dk owns the 132kV grid in northern Zealand. Energinet.dk is thus both TAO and TSO.

Ownership of transmission assets

Both the offshore and onshore transmission voltages are 132kV, 150kV and 400kV.

A.3.2 Offshore transmission planning

The Danish TSO Energinet.dk is responsible for transmission system planning and investment in the Danish electricity grid. They are also required to develop a comprehensive annual system plan which outlines any future investments. These plans are designed to be consistent with the Danish government's Energy Strategy 2025[59]. Since Energinet.dk is responsible for the offshore transmission system, the overall transmission system development plan also includes connectors to the OWFs planned in the future. These plans included as a part of ENTSO-E TYNDP.

It is also worthwhile mentioning the Kriegers Flak; a triple project (potentially 3x600MW) planned on the EEZ borders of Sweden, Germany and Denmark. According to the feasibility study [17] conducted by the three TSOs involved (50Hertz, Energinet.dk and SvK), it is envisaged that the offshore transmission systems from each OWF to the respective countries will be HVDC, with AC interconnections between the three OWFs. Although SvK, the Swedish grid operator has pulled out due to lack of interest from potential investors in the OWF, the German and Danish projects are still planning to go ahead. It is expected that the next tender in Denmark will be for a 600MW OWF at Kriegers Flak. It should be noted however that both Denmark and Germany different feed-in tariffs apply and this issue is yet to be resolved.

A.3.3 Connection process

If site concession is awarded through the competitive tendering process Energi.dk will establish the offshore transmission system (including the offshore step-up transformer).

However, if site concession is awarded following open door application, the generator will initiate the connection process by applying to Energinet.dk. It is expected however that this route will not be followed by future large commercial OWFs because of the high costs associated with the

[59] Note a later version, Energy Strategy 2050, was released in February 2011 [20]

transmission assets, which can make up 10-30% of the total offshore project costs depending on distance to the shore [4].

A.3.4 User commitment/financial security and transmission charges

Energinet.dk is responsible for the funding of all offshore and onshore transmission system connecting OWFs to the grid. Individual generators incur only shallow connection costs at the LV side of offshore substation.

While generators do not bear the cost of their offshore transmission assets, they must demonstrate their commitment to construct their OWFs and connect to the grid. For example, the tender documents for the Anholt wind farm required a DKK 100M (EUR 13M) guarantee to the DEA within one week of winning the contract. This guarantee requirement increased to DKK 200M (EUR 26M) after five months and up to DKK 400M (EUR 55M) at the end of one year. The guarantee was released once they could prove an incurred expenditure of DKK 1b (EUR 134 m) for the establishment of the electricity production plant [9]. Until they reached this milestone, the guarantee could be drawn down under penalties in the connection agreement.

The recovery of costs associated with the use of the transmission system [8] is based on the charge at the offshore connection point. TNUoS tariffs for generation and demand differ. Different transmission tariffs are set for the Western and Eastern parts of Denmark. Three tariff components on consumption are applied in the settlement between Energinet.dk and the grid companies [7]:

- grid tariff covering Energinet.dk's costs relating to the transmission grid (400/150/132kV);
- system tariff relating to reserve capacity and system operation; and
- Public Service Obligation (PSO) tariff covering Energinet.dk's costs relating to public service obligations as laid in the Danish Electricity Supply Act, including the cost of renewable energy, research and development. The PSO component relates directly to the costs associated with renewable energy and is intended to allow renewable producers to be guaranteed a fixed price for supply. Energinet.dk tariffs for 2010 show the PSO component represented approximately 69% of the overall tariff in the West and 44% in the East. The recent "Energy Strategy 2050" report has also indicated that a small part of the PSO will be contributed by gas consumers as well[60].

The grid tariff on generation is much smaller compared the grid tariff on consumption. The grid tariff on production is 3.3% and 1.1% of the grid tariff on consumption in the West and the East respectively.

[60] PSO is meant to support all renewable generation; hence replacing gas with biofuel also is supported by PSO.

A.3.5 Consenting Process

The concession is coordinated and administered by the DEA (one stop shop approach) under the following process [4, 5]:

1) License to carry out preliminary assessment such as environmental and technical studies
2) Following this preliminary report, the license to establish the OWF, under specified conditions, is granted.
3) If the project is larger than 25MW then a concession for electricity generation will be required but the application must be backed by a report showing that the specified conditions have been met.

Eighteen areas of interest such as fishing, ferry routes and sea depth need to be considered as part of the consenting process. The various areas can be categorised under two main priority criteria:

- different fields of interest exist which have to be balanced; and
- a priority field of interest already exists.

During the consenting process, the developer has to consult with all stakeholders involved: private, government and local organisations. Weighting of the interest for society and the final decision is taken by the DEA.

To establish an offshore transmission system, Energinet.dk is required to obtain a concession from the DEA. Concession is mandatory irrespective of the form of the offshore transmission system. Hence offshore transmission systems for OWFs and international interconnectors are subject to the same legal regulation.

A.3.6 Current major projects

- Middelgrunden, 40MW – Commissioned in 2001
- Horns Rev I, 160MW – Commissioned in 2002
- Horns Rev II, 209MW – Commissioned in 2009
- Rodsand I (Nysted), 165MW – Commissioned 2004
- Rodsand II, 207MW – Commissioned 2010
- Anholt, 400MW – Consented, must start producing by the end of 2012, must be fully commissioned by the end of 2013

A.3.7 References

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[9] Tender Specifications for Anholt OWF (30 April 2009) http://www.ens.dk/en-US/supply/Renewable-energy/WindPower/offshore-Wind-Power/anholt_tender/Documents/udbudsbetingelser%20Anholt%2030%20april%2009%20ENDELIG%20_m%C3%A5l%20eng_.pdf
[10] Timescales for Horns Rev OWF http://www.hornsrev.dk/images/tidsplan_uk.gif
[11] Rødsand II Wind Farm, Denmark http://www.power-technology.com/projects/rodsand/
[12] Wind Power in Denmark http://en.wikipedia.org/wiki/Wind_power_in_Denmark
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[19] North Seas Countries Offshore Grid Initiative Memorandum of Understanding
https://www.entsoe.eu/fileadmin/user_upload/_library/news/MoU_North_Seas_Grid/101203_MoU_of_the_North_Seas_Countries__Offshore_Grid_Initiative.pdf

[20] The Danish Government, Energy strategy 2050, February 2011
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A.4 Netherlands

The Netherlands are committed to mandatory targets for renewable energy set by the Directive on the Promotion of the Use of Energy from Renewable Sources. The target is for 14% share of renewable energy sources on the final consumption of energy in 2020. [2] An earlier target of 6000MW of offshore wind by 2020, presented by the 2002 Energy Report, has been discussed and referenced repeatedly, most notably taken by the TSO TenneT as benchmark for planning the offshore transmission system. [3] The June 2010 "National Renewable Energy Action Plan: Netherlands (2010)" presents an estimation for the contribution of renewable energy up to 2020 which does not quite reach this target though it is not significantly less either.

The NMa (Netherlands Competition Authority) acts as a regulator ensuring transmission quality and setting the tariffs.

To date there are four operating OWFs in Dutch water though only 2 of those are over 100MW in capacity [4]. These are all connected on the distribution level. These OWFs are referred to as the "Round or Phase 1" wind farms (total 247MW). However there are currently at least 14 additional developments with consent, based upon the North Sea Office Wind Overview Map (Feb 2011). [7] Unconstructed but consented developments that come under the current SDE tariff round are referred to as the "Round or Phase 2" wind farms (notionally 950MW though unlikely to be realised). The 2009-2015 National Water Plan (NWP) has defined 2 broad areas for the "Round/Phase 3" wind farm development which effectively restricts further OWF consenting in these areas. [2] To date 3 developments have been consented for construction within the Round 3 areas. [7] Phase 3 developments were intended to be in the order of 4,800MW as set out in the NREAP [9]. However the third round did not commence due to political uncertainty and changes recently introduced to the feed in tariff structure.

In July 2011, a new feed in tariff scheme was introduced. The SDE+, which replaces its predecessor the SDE, is a feed-in premium mechanism whereby a maximum subsidy level is set, in contrast to the previous scheme, and renewable producers receive the difference between this subsidy and the wholesale power price. The tender is organized in four phases, with the tariff ceiling gradually increasing up to EUR 150/MWh, and is open to technologies including offshore wind. During the first year, the premiums will be distributed on a 'first come, first served' basis. Although OWF technology is required to be a key contributor to the Netherlands renewable targets, the EUR 1.5b allocated for the SDE+ 2011 scheme is expected to be consumed by other renewable technologies. This is because the tariff is not deemed to be able to provide sufficient returns compared to the high capital costs[61].

The economic crisis and the unsatisfactory tender results for the previous OWF tendering rounds, including several objections and procedures in court, have reduced interest in offshore wind development and have resulted in new strategies by the government to reach the 2020 renewables targets. The current government wants to achieve the target of 14% renewable energy by 2020 with the cheapest options for renewable energy promotion especially through the new feed in tariff SDE+ (July 2011).

The government, at present, has no specific target for offshore wind as this is still a very expensive option and results in budgetary consequences. The sector is awaiting substantial price falls over time, but it would take a sharp drop in prices before the rollout of offshore wind power through the SDE+ becomes realistic. If the expectations are accurate, then offshore wind energy will become an interesting option in due time. The position of the current government is that on the basis of the fore mentioned there is no short term urgency for taking action [15].

In early 2010 the Netherlands signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding [8].

The COBRA cable project is a potential international HVDC interconnection between Denmark and the Netherlands. It is envisaged that this would form a part of the North Sea offshore grid and is aimed specifically at promoting and supporting the integration of renewable energy (particularly wind). The scheme has been supported with EUR 86.5M from the EU Economic Recovery Plan and the intention at this stage is to provide a potential direct connection for OWFs to the offshore cable. The international interconnection is scheduled to be operational by 2016 subject to a decision to begin construction in 2012. [12]

A.4.1 Transmission assets classification, ownership and O&M

The Netherlands transmission system has a single TSO, TenneT. In April 2011 TenneT began to sub-manage the Stedin 150kV regional transmission grid bringing the entire Dutch high voltage transmission network, under TenneT's control, down to 110kV. Ownership of the transmission grid is split, though TenneT is actively working to buy out other owners as a result of the

[61] Dutch Renewables Falters with New SDE+ Policy, Uhttp://www.emerging-energy.com/Content/Document-Details/Renewable%20Power/Dutch-Renewables-Falters-with-New-SDE-Policy/1109.aspxU
Netherlands Renewable Energy Policy Review, Uhttp://www.erec.org/fileadmin/erec_docs/Projcet_Documents/RES2020/NETHERLANDS_RES_Policy_Review__09_Final.pdfU

Independent Grid Administration Act which allocates all 110kV and higher grid administration, operation and investment decisions to TenneT. [10] Regional grid operators maintain and construct customer connections at 150kV or less.

How the offshore transmission assets are classified

The onshore and offshore transmission voltages are both classified as 110kV and above.

Ownership of the offshore transmission assets

Currently the developer is responsible for the funding, construction and ownership of a radial offshore transmission system but the operation will be the responsibility of either the TSO or the owner of the line.

For potential collective connection, it is envisaged that the responsibility for funding, construction and ownership and operating the offshore transmission system will fall on the TSO but this is currently under review by the government[62]. Details on the financing, building, ownership and operation of an offshore transmission system to an interconnector is unavailable and currently under review.

In 2008 the Minister of Economic Affairs undertook an investigation into the provision of offshore transmission systems by TenneT. This is referred to as "the Samson Motion". Subsequently a study was completed analysing options for offshore transmission systems. A number of potential scenarios were based around four likely onshore connection points (Eemshaven, Ijmuiden, the Maasvlakte and Borsele). Due to the time required to establish a legal basis, the OWFs currently in competition for feed in tariff will not be provided with offshore transmission systems built by TenneT, regardless on the final decision of the government. [11]

Construction of the offshore transmission systems

In February 2010, the Dutch government approved for TenneT to be responsible for the construction and management of offshore transmission systems. [1] A corresponding bill was to be prepared in order to establish TenneT's responsibility for the offshore transmission system in Dutch law. The collapse of the Dutch government in 2010 was one of the reasons that no decision has been made. In December 2010, a bill was prepared, creating the opportunity for TenneT to connect OWFs to the onshore grid, where it is considered more efficient than construction and management by the free market players. There are no examples of instances when this would be considered a case. This bill also focuses on how the TenneT can fund and recover such investments [15].

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[62] Information provided by NMa

A.4.2 Connection Process

Applications for connection of OWF, are made by the developer to the nearest onshore grid operator and depending on the voltage level this can be a regional grid operator or the TSO. Connections above 10MVA may be tendered by the applicant.

The connection process follows several steps: The initial phase (clarification of project); followed by a brief study; and then tender of a connection offer. The brief study and tender typically take 7 weeks. If the tender is accepted by the customer, the connection offer is generally ready in 3 - 5 months[63].

The shallow connection cost, will be borne by the developer through the connection tariff [2]. Wider onshore transmission system reinforcement cost associated with the OWF connection, will be borne by the system operator and recovered through transmission network use of system tariffs [9]. The connection tariff has an initial one time component to cover capital costs and an annual component to cover maintenance expenses. There is also a possibility for refunds if the other parties subsequently require use of the facilities [13]. The connection tariff must be taken into account in the SDE tariff level bid through the tendering process. There is motion to enshrine in law that TenneT would offer to take responsibility for design, funding, construction and operation of the offshore transmission system, where clearly more efficient in comparison with the construction and management by the free market players [15]. The decision has not yet been made.

TNUoS charges currently apply only to demand customers [14]. However, due to the increase of production capacity in the Netherlands, there is an increasing need to change this in the near future.

A.4.3 User commitment/ financial security and transmission charges

As mentioned above, OWF developers bear the cost of the associated offshore transmission system. The offshore generators are currently not required to demonstrate any commitment to secure their connections to the national grid. This is currently under review[63].

A.4.4 Consenting Process

The NREAP, drawn up under Directive 2009/28/EC describes how the Netherlands intends to meet its renewable energies targets and includes extensive information on regulation and consenting. [9]

Consenting is administered by the National Water Department for the North Sea (DNR, part of The Ministry of Infrastructure and the Environment) and the key applicable law is the Water Management Act applicable to the Dutch Exclusive Economic Zone (NEEZ) (excluding fresh waters). Offshore wind energy developments must take into account “the environment / ecosystem of the North Sea, as well as considering other users of the sea (e.g. military areas, shipping routes,

[63] According to information from NMa

disposal sites, search areas, coarse sand resources and cable routes etc.)". [2] In principle the entire NEEZ is open to OWF permitting however this is in practice limited by the draft NWP. [5] The "Government Coordination Scheme" provides a one-desk policy where the Ministry for Economic Affairs will coordinate communication between the applicant and relevant administrative bodies. [2]

A.4.5 Current major projects

- Egmond aan Zee, 108MW – Commissioned 2007, connected at 34kV
- Prinses Amalia wind park, 120MW – Commissioned 2008, connected at 150kV, which was classified distribution at the time. There hasn't been any change of status for this connector even after 150kV onshore network went over to TenneT in April 2011.

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A.5 Republic of Ireland

There is currently only one OWF in Ireland (25MW), the Arklow Bank Offshore Wind Park [1]. The facility went on-line as a demonstration plant in June 2004 and is owned and operated by GE Energy. It was co-developed by GE Energy and Airtricity.

Ireland currently has no specific offshore wind targets. The offshore wind capacities, included in Ireland's NREAP submitted to the EU in 2010 and assigned firm connection offers under the Gate 3 grid connection process, both foresee less than 600MW of offshore wind installed by 2020 [13]. Lengthy process, lack of clear timescales for decisions to be made and no priority for OWFs over other developments all add uncertainty to the process. Furthermore, given the long grid connection time-scales, planning consents lapse for many developments before a grid connection is available [13].

In 2010, Ireland signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding.

A.5.1 Transmission assets classification, ownership and O&M

The operation and ownership of the Irish transmission assets are a separate licensing act determined by the Commission for Energy Regulation (CER). On the 27th July 2011, under the context of the EU Third Energy Package, a decision was made for the ownership of the electricity transmission to remain with Electricity Supply Board (ESB) Networks, while the O&M remains the responsibility of EirGrid. EirGrid is responsible for the national grid and holds licenses as the TSO and MO (Market Operator) in the wholesale trading system in Ireland. The Single Electricity Market Operator (SEMO) is part of the EirGrid Group, and operates the Single Electricity Market (SEM) on the island of Ireland.

How the transmission assets are classified

The onshore and offshore transmission voltages are both classified as 110kV and above.

Ownership of offshore transmission assets

The TSO is often responsible for the transmission assets. However, the transmission connected customers may also choose to construct their own offshore transmission system and, depending on the agreement between the TSO, they may also own the offshore transmission assets.

In some cases, the TSO might request that the assets are transferred to the national TAO, ESB Networks. Under the Electricity Act 1999, CER has the power to direct that the ownership of an asset is transferred to the ESB Networks. If CER approves the request, then the assets will be transferred to the ESB Networks for a nominal fee. Such a request of transfer may be carried by the TSO for cases where the transmission assets are to be shared by several generators or the transmission assets have been oversized, as part of wider system developments or to maintain the security of the system. [12]

A.5.2 Offshore transmission system planning

In June 2011 EirGrid released the Executive Summary of the Offshore Grid Connection Study (the study is to be released shortly). Some holistic views have been expressed for the future development of offshore grid by 2020. According to the study the overall offshore transmission system design should [9]:

- be meshed or interlinked and not a series of point-to-point connections;
- be developed incrementally;
- be symbiotic with the onshore network and in line with GRID25 strategy;
- be developed making use of "smart" devices to enhance network flexibility; and
- consider the interlinking of both AC and DC offshore network cables. However according to the “Draft Offshore Renewable Energy Development Plan (Nov 2010)” [10], AC technology will be preferred over DC because of the short distances involved. Overall modular electrical design that will permit changes from AC to DC and vice versa will be investigated.

In the future, it is envisaged that offshore transmission systems may be extended to become an international interconnector to GB and/or form part of an Irish Sea grid as part of the North Seas Grid Initiative.

A.5.3 Connection Process

In December 2004, a "Gate" process was adopted whereby applications for connections are processed in batches. This method is known as the Group Processing Approach. Within these Gates, applications are further subdivided based on the optimal network required to connect them. The group processing of the connection offers can be proposed either by EirGrid as the TSO or ESB Networks as the Distribution System Operator (DSO) and approved by the CER. Any renewable developments with a Maximum Export Capacity (MEC) greater than 0.5MW must seek connection through the Group Processing Approach. This also includes the connection of OWFs [2].

Gate 3 had offers for 3,900MW of renewable generation capacity (795MW of this has been offered to offshore wind projects). On acceptance of the connection offer each applicant must post a Capacity Bond. For transmission connected customers, the connection agreement includes a set of milestones during construction and a backstop date by which the generator must be connected. If the terms of the connection agreement are met by the back stop-date, then the Capacity Bond is released. Otherwise the system operator has the right to draw down the bond. [3] [4] [5]

EirGrid is responsible for the transmission connection agreements. It is possible to transfer connection offers between TSO/DSOs based on the location of the onshore connection point which is determined through the connection studies; whether the connection point is on the distribution system or the transmission system.

In the transmission agreement, EirGrid will specify the parts of the transmission system that are deemed as contestable. The developer or the sub-group may choose to construct the contestable part of the transmission assets themselves, thus providing the developer with some control over the costs and timing. However, the contestable assets must still be built to meet the system operator's standards. Depending on agreements, the assets constructed by the developer may also be owned by the developer. However in some circumstances, the TSO may request for the ownership of the assets to be transferred to the TAO as described above in section A.5.1.

A.5.4 Shared assets, anticipatory investment and oversizing

While anticipatory investment and reinforcement may be completed onshore for future generation, the current Gate process would not lead to anticipatory investments in offshore transmission systems. Anticipatory investments on the offshore transmission network would also be in breach of standard connection requirements unless they were able to connect capacity within a year. Non-firm connection offers have only been used for security of supply grounds and may be seen as a route to circumvent the first-come-first served basis of the current Gate process.

A.5.5 User commitment/financial security and transmission charges

Generators connecting to the transmission grid are required to pay shallow connection costs. Generators must fund the full cost of both the dedicated onshore and offshore transmission assets. The cost of any shared transmission assets is split between connecting generators on a per MW basis [14]. If any other party connects to the assets previously paid for as either shared or dedicated connection assets, within ten years of energisation, a per MW rebate will be paid to the earlier connecting generators.

The system operators require financial security from generators as part of the connection process to demonstrate their commitment and deter the hoarding of network capacity.

- All renewable generators must pay a EUR 25,000 per MW of the MEC as a Capacity Bond. The Capacity Bond must be submitted two years after the Consent Issue Date (the date at which all consents have been obtained by the developer or TSO) and less than one month before energisation. This is repaid to the generator if 95 percent of their requested capacity is achieved within one year of energisation. If not, this bond is drawn down pro-rata based on the percentage shortfall in the maximum achieved by the end of the year. The full bond will be drawn down and connection agreement terminated is the MEC is not achieved within four years. The bond is non-refundable if planning permission is not achieved.

- Generators connecting to the transmission system must also pay a Connection Charges Bond as financial security for the outstanding connection charges not paid by the consents issue date. This is drawn down if the project does not connect and EirGrid's costs incurred exceeded the sums already paid.
- At present, the connection payments are distributed as follows [15]:
  - the lesser of 10% or the lesser of EUR 10,000 per MW on Offer Acceptance (First stage payment);
  - 50% at the Preconstruction Stage; and
  - the balance at Final Energisation.
- There is no longer any requirement to post a Decommissioning and Reinstatement bond as the cost of the bond was considered to be too high compared to the risk faced by the System Operator.

The TNUoS charges comprise of network charges for the use of the transmission network and also system service charges for the operation and security of the transmission system. For generator connections, the network charges are calculated on the basis of the MW to be connected and location whereby the closer the project is to the demand, the better the transmission tariff. [5] [6]

A.5.6 Consenting Process

The Foreshore Act 1933 governs any construction activities on the costal zones of Ireland. This provides the Department of Environment, Heritage & Local Government with the power to award a foreshore lease/license. Before the development of an OWF can begin, it is necessary to gain a foreshore license (granted for approximately 4 years) in order to assess the site and to carry out the EIAs. Following successful pre-application consultations with the Foreshore unit, the developer can then apply for a foreshore lease in order to construct and operate an OWF development. The duration of the grant is usually 35 years and this is subject to five –yearly rental reviews. Note that the Arklow bank wind farm was granted a 99-year lease in 2002, before amendments to the Act were made to accommodate OWF projects.

On top of the Foreshore Lease, the developer must also gain permits from CER for construction, generation and supply. [7] [8]

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A.6 United States of America

The USA is in the very early stages of offshore development. Unlike European Countries, in the USA the transmission network is broken into 3 separate synchronized grids: the Eastern Interconnect (eastern two-thirds of the continental USA and Canada from Saskatchewan east to the Maritime Provinces); the Western Interconnect (western third of the continental USA, excluding Alaska, the Canadian provinces of Alberta and British Columbia, and a portion of Baja California North, Mexico); and the ERCOT (Electric Reliability Council of Texas) interconnect that covers most of Texas. There is relatively little power transmission between "Interconnects" which are tied together with a number of HVDC and HVAC (High Voltage Alternating Current) interconnections. [1]

Regulation is managed on a number of levels starting with the North American Reliability Corporation (NERC) as the designated national Electric Reliability Organisation (ERO). The NERC develops standards for power system operation as well as monitoring and enforcing compliance. NERC also assesses system adequacy annually with a ten year forecast and investigates large system disturbances.

The NERC oversees eight regional reliability entities, which carry out enforcement activities and manage the network at a regional level and are: [2]

- Florida Reliability Coordinating Council (FRCC)
- Midwest Reliability Organization (MRO)
- Northeast Power Coordinating Council (NPCC)
- Reliability First Corporation (RFC)
- SERC Reliability Corporation (SERC)
- Southwest Power Pool Regional Entity (SPP RE)
- Texas Reliability Entity (TRE)
- Western Electricity Coordinating Council (WECC)

Mandatory renewable energy targets have not been set by the Federal Government though a number of states have binding "renewable portfolio standards" which require electricity providers to source a minimum percentage of power from renewable energy sources. [14]

The renewable energy industry is supported with an array of subsidies, feed in tariffs and tax exemptions. [10] The Incentivising Offshore Wind Power Act has been introduced to extend the federal wind energy investment tax credit to OWFs which is designed to provide financial stability to developers required to bring OWFs to completion. [11]

The US Department of Energy (DOE) is providing some drive toward renewable development with research and development programs aimed at reducing the cost of offshore wind and water with the Wind and Water Power Program. The DOE's Wind Program has examined the potential for wind to supply 20% of the nation's requirement by 2030 (54,000MW of Offshore wind, 10,000MW by 2020) and has produced "A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States" to outline the avenues it will pursue to support the development of offshore wind in the USA. The key targets of the Offshore Wind Innovation and Demonstration (OSWInD) initiative are to reduce the cost of offshore wind and reduce the timeline for offshore deployment. The national Offshore Wind Strategy will augment more than USD 90M allocated by the DOE for offshore wind research and test facilities supported by a further USD 78M in American Reinvestment and Recovery Act of 2009 (ARRA) funds.

Atlantic Wind Connection is led by Trans-Elect (TAO and TSO) who are backed by strong financial sponsors such as Good Energies, Google and Marubeni Corporation. It proposes a 7,000MW HVDC "Backbone" which will serve as a number of nodes that OWF developers may use as their offshore connection point. The development is intended to accelerate offshore development and is intended to be extendable to accommodate future expansions of capacity. HVDC is proposed for easier integration and control while avoiding the high electrical losses associated with long distance HVAC connections. The backbone will be tied into the strongest, highest capacity areas of the onshore grid to minimize reinforcements. Notably this project has taken the first step in submitting a right of way application to BOEMRE [9]

- **Figure 20 Atlantic Wind Connection's "Backbone" Offshore Transmission Project [9]**

Dominion Power is in the early stages of investigation into a similar transmission project to the Atlantic backbone, though in this case a collective connection is envisaged that would reach out into the Atlantic for OWFs. As for the backbone project this is a TSO/TAO led scheme. [12]

A.6.1 Transmission assets classification, ownership and O&M

Transmission system investment and ownership is undertaken by the TAOs under the guidance and regulation of the RTOs (Regional Transmission Organisation) and ISOs (Independent System Operator). The specific responsibilities of each of the stated parties vary significantly and are continually evolving.

The operation of the transmission system is controlled, coordinated and monitored under the supervision of the NERC by a number of RTOs and ISOs. RTOs and ISOs perform the same general functions though the RTOs generally cover a larger area and are required to meet FERC transmission planning and expansion regulations.

How the offshore transmission assets are classified

The onshore and offshore transmission voltages are both classified as 110kV and above.

A.6.2 Connection Process

A new generator must complete a number of steps interacting with a number of entities to achieve connection. The connection request is submitted to and processed by the relevant ISO. The connection point options are identified by the ISO, Interconnection Customer (Developer), Interconnecting Transmission Owner, and any Affected Party as deemed appropriate by the ISO at a scoping meeting. The specific points to be analysed following this meeting are chosen by the Interconnection Customer. The point of change of ownership is the point at which ownership changes from the Interconnection Customer and the TAO is not defined in any detail in the documentation reviewed and appears to be negotiable.

The ISO will coordinate the studies required to determine the impact of the connection request and requirement of system modifications. The Interconnection Customer is responsible for all costs associated with these studies. Upon special request the Interconnection Customer may be granted leave to begin acquisition of long lead items while connection studies are still ongoing. The studies will result in a Large Generator Interconnection Agreement which will then allow the construction process to begin with mutual agreement and coordination between the Interconnecting Transmission Owner and Interconnection Customer. The cost responsibility for modifications to the transmission system is defined within the studies[64] [2].

It appears that no specific procedures are available for the connection of OWFs, though this is not surprising as there are currently no offshore developments existing in the USA.

A.6.3 Shared transmission assets, anticipatory investment and oversizing

The U.S. Department of Energy's National Offshore Wind Strategy [13] backs coordinated approaches such as "backbones." However, the planning of the Atlantic Backbone came from the sponsor consortium and transmission owners rather than part of a wider planned approach. If constructed, the Atlantic Backbone will become a regulated transmission asset and its costs will be recovered through PJM's allowed revenues even if no OWFs have connected.

The Backbone project will act as an interstate connector even if no projects are connected. However, if development fails to the point that the project is abandoned for reasons outside the company's control, Atlantic Wind can get approval from FERC for all prudently incurred costs including any construction work in progress and preconstruction expenses to be recovered by PJM [16].

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[64] Note that this information is based upon only the New England ISO procedures and will vary with ISO

A.6.4 User commitment/financial security and transmission charges

The Atlantic Coast offshore East Coast Backbone will set the precedent for the treatment of offshore transmission assets in the USA. This project will be funded as a regulated transmission asset once approved in PJM Interconnection's regional transmission plan. PJM is the RTO in the Eastern Interconnection Grid.

To receive the necessary connections to the PJM network, permissions must be obtained through standard generation and transmission connection procedures. As part of this process the applicant must post deposits to pay for feasibility, system impact and connection facilities studies. Within 60 days of receiving an Interconnection Service Agreement, the applicant must also provide a letter of credit or another form of acceptable security equal to the estimated costs of new facilities or upgrades for which the applicant is responsible [15]. Procedures may vary across the various jurisdictions and networks in the USA.

A.6.5 Consenting Process

Consenting will involve numerous state and federal agencies however it will be led and coordinated through a relatively developed (though little tested) system for leasing sea bed and approving offshore wind which is led by BOEMRE. BOEMRE is responsible for the overseeing of the safe and environmentally responsible development of energy and minerals offshore. This organisation is responsible for developments within the Outer Continental Shelf (OCS), approximately 3 to 200nautical miles (5.5-370.4km) from shore. Currently licences for Hydrokinetic Plants (wave and tide) still rest with the Federal Energy Regulation Commission (FERC) though leasing rests with BOEMRE. Sole jurisdiction for wind rests with BOEMRE. [4]

So far, BOEMRE has defined[65] 4 appropriate designated areas for wind development as part of the "Smart from the Start Initiative", based upon detailed environmental and practical assessments. Leases are envisaged to be granted on a competitive basis, though initial leases are expected to be issued in response to unsolicited bids.

BOEMRE's wind energy program is intended to occur in 4 stages as shown below [5]:

1) Planning and analysis: Identify suitable areas for wind energy leasing as with the 4 zones announced on the Atlantic OCS.
2) Lease issuance: Issuance of a commercial wind energy lease by way of competitive bidding, where appropriate, which grants the licensee the exclusive rights to subsequently seek BOEMRE approval for the development of the leasehold.

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[65] Currently in draft for comment and assessment

3) Approval of a site assessment plan (SAP): Submission by the licensee, and approval or rejection by BOEMRE, of a SAP. A SAP is a detailed proposal for the construction of a meteorological tower and/or the installation of meteorological buoys on the leasehold.
4) Approval of a construction and operation plan (COP): Submission of a COP by the licensee, the COP is a detailed plan for the construction and operation of a wind energy project on the lease. BOEMRE may approve, approve with modification, or disapprove a licensee's COP.

BOEMRE has jurisdiction over all installation on the OCS; but onshore and within 3 miles from the coast, the state authorities have jurisdiction. As part of the Smart from the Start initiative BOEMRE is working with state partners to define the preferred development zones though it appears that landing point and onshore details will have to be negotiated with the relevant local authorities by the developer as would be expected.

A.6.6 Current major projects

Cape Wind is the first project to have a COP approved and move into the pre-construction phase. This development will consist of 130 x 3.6MW wind turbine generators in federal waters offshore from Massachusetts [6]. The COP is largely available in the public domain [7].

There are a number of other offshore projects and initiatives are in various stages of development and approval as listed below. [8]

- Offshore wind developer Deepwater Wind is pursuing a 200 turbine, 1,000MW project 20 miles off the Rhode Island coast.
- Offshore wind developer Fishermen's Energy received the final state permits to build its six turbine Atlantic City wind park demonstration project.
- Offshore wind developer NRG Bluewater Wind began negotiating a lease with the federal government for a 49 turbine project near New York.
- Governor O-Malley advanced offshore wind with consideration of the Maryland Offshore Wind Energy Act, which would guarantee revenue for a 500MW OWF. Though paused at the moment, hopes are to pass it in the next session.
- Utility Dominion Power announced a study evaluating an offshore wind transmission line.
- The just introduced Offshore Wind Jobs and Economic Development Act would make long-term contracts with state utilities to purchase 2,500MW of offshore wind expected to come online in the next 10 years.
- The **Atlantic Wind Connection's** proposed 300 mile offshore East Coast backbone transmission line advanced a few weeks ago by filing, the first-ever unsolicited right-of-way application with BOEMRE.

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A.7 France

The development of OWFs in France is currently in the early stages. The French government has set a target to develop 6,000MW by 2020 though there are anticipated difficulties in meeting these targets. France had previously operateda single renewable tariff but this was abandoned in favour of OWF tenders[66].

To initiate the OWF development, the government made a call to tender for five separate sites totalling 3,000MW of offshore wind power installations. The call was launched in July 2011 and the winners are expected to be selected in May 2012. Construction is expected to start in 2015. A second call to tender is also expected around April 2012. [4] [5]

The Commission de régulation de l'énergie (CRE) regulates the tender process on behalf of the French Ministry of Energy. However the final decisions will be made by the Ministry for Ecology, Sustainable Development, Transport and Housing and the Ministry for the Economy, Finance and Industry based on advice provided by CRE. [4]

The tendering system employed is geared towards large, financially strong companies and joint applications by several bidders are also accepted. The applicant requirements include:

- to have a level of equities higher than 20% of the entire amount of the investment; and
- bidders must provide financial guarantees to cover the costs of decommissioning and site rehabilitation after operation. The guarantee must be a minimum of EUR 50,000 per MW installed.

The bidders are invited to send an offer to CRE for one or more of the sites by 11 January 2012. [4] [6] [7] [14]

In 2010, the France signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding.

A.7.1 Transmission assets classification, ownership and O&M

The transmission networks are operated by RTE, a subsidiary of EDF which under the 3rd package regulation, is acting as a TSO, while public distribution networks are owned by the municipalities who may entrust the management to EDRF or local distribution companies through concession contracts. [3]

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[66] Information obtained from CRE

The operation of the transmission and distribution networks is regulated by the French energy regulator, CRE. The CRE has the power to formally approve the rules of calculation and allocation of connection capacity.

How the transmission assets are classified

The French electricity network is divided into three different levels:

- transmission network (400kV or 225kV);
- regional networks (225kV, 90kV, 63kV); and
- distribution networks (20kV, 400V)

There is no differentiation between the classification of offshore and onshore transmission assets.

A.7.2 Connection process

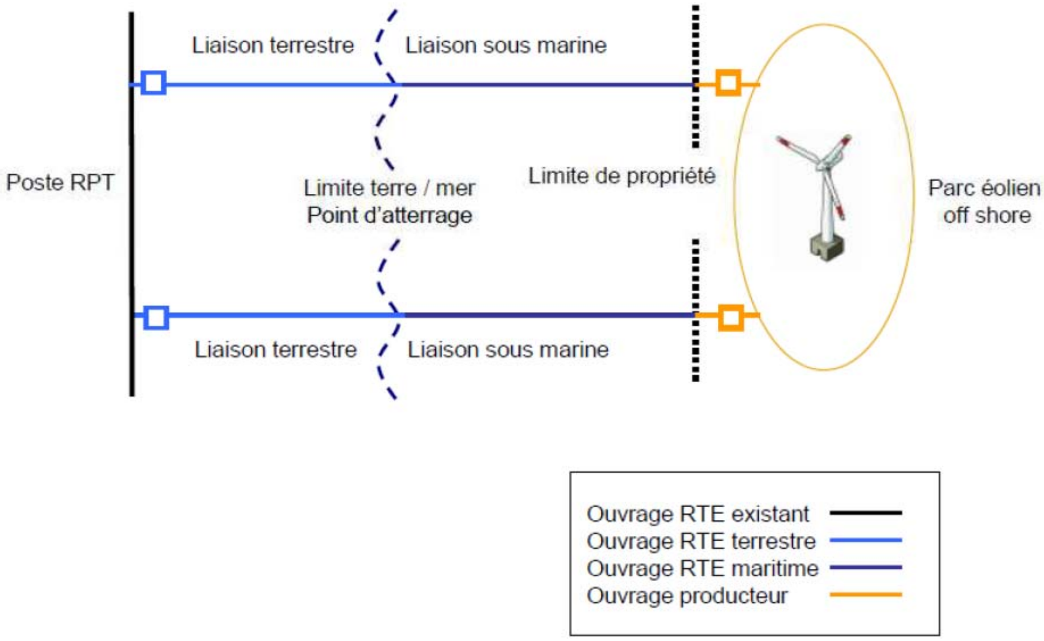
In line with the tenders for OWF development, RTE reserves substation capacity onshore for these developments.

When the generator demands connection to a network, the general procedure is for the TSO to produce a technical and financial proposal, proposition technique et financière (PTF), within three months. This evaluates the technical and financial requirements of the connection and proposes one or more solutions. Depending on the solution accepted by the generator, the time and cost of the connection is then fixed. RTE will then launch planning studies and consultation processes to obtain administrative permits for the offshore transmission system. The generator signs a connection agreement with RTE once the permits are obtained so that the works can begin and this is followed by the signing of a network access contract and operating agreement. If the final connection costs are higher than that of the PTF framework, then the TSO is required to outline the origin of the additional cost and the nature of technical constraints that could not be taken into account in the PTF. The final costs will be taken into account by an adjustment of the buy-back price.

The TSO recovers the cost of the offshore transmission system through the connection tariffs. However any necessary network reinforcement costs cannot be passed on to the generator alone and instead it is recovered through TNUoS tariffs. This tariff has a postage stamp rate (i.e. same throughout the country depending on the voltage level). [10] [11] [12]

A.7.3 User commitment/ financial security and transmission charges

RTE will fund the cost of the offshore transmission assets and any wider reinforcement costs. These costs will be recovered from the generator as it is deducted from the tariff it receives for energy produced [7]. As highlighted in Figure 1 below, the generator would own and operate the internal OWF grid, with the offshore transmission system owned and operated by RTE. Note that the cost of the offshore transmission assets is included in the fixed price of electricity, calculated at the bidding stage and adjusted depending on the actual costs. Therefore the generator will recover the cost of the offshore transmission assets through the sale of electricity.



- **Figure 21 Estimated timeline from bidding to the commissioning of the OWFs [6]**

In addition, the tender requires financial and performance guarantees from the bidders. One requirement is that the shareholders' equity in a bidder be no less than 20% of the total amount of the investment. Bidders are also expected to provide guarantees to the relevant ministries of EUR 50,000 per MW installed. This guarantee is partially released as milestones are completed (e.g. procurement of the contracts with suppliers or authorities, submission of studies and completion of stages 1, 2 and 3 described above). The bond may be drawn-down due to delays or penalties incurred at each milestone. The remainder of the guarantee must be fully released upon full commissioning of the facility [15].

If there are any failures to comply with the obligations and regulations, sanctions can be imposed on the developer. If this occurs after the operating licence is issued, the sanctions can include financial penalties and the withdrawal/suspensions of authorizations, but without prejudice on any damages arising from the need of a new tender process. If this occurs before the issue of an operating licence, then the developer may be subject to a penalty of EUR 100,000 or loss of the eligibility to tender.

Whilst the development of offshore wind in France is at early stages, RTE, is involved in discussions regarding the zoning of future OWFs [16].

A.7.4 Consenting Process

The permitting process in France has been simplified so that only three authorisations are necessary[67]:

- Maritime Public Domain Concessions:

  The operators of OWFs in France must hold a domain concession in order to operate their facility on the French waters. The maximum period for which a domain concession can be granted is 30 years.

- Authorization pursuant to water regulations:

  The Environmental Code (art. L214-1) obliges offshore installations over EUR 1.9M to authorization under the Water Law. This related to the construction work in territorial waters (e.g. to bury cables or lay foundations). Application for an administrative authorization can be carried out in parallel with that of a domain concession. This must include an environmental impact study.

- Electricity operation authorisation:

  Authorization to operate a facility producing at least 4.5MW of electricity.

It is expected that there will no longer be a requirement for a construction permit though this law is yet to be proposed. Consultations have also been organised to reduce the visual concerns of OWFs.[68]

The selected bidder must apply to the Departmental Prefects who are responsible for granting concessions and water law authorizations within its territorial waters, under the consultation of the Maritime Prefects. Instruction permits under the Water Act and the maritime public concession are subject to a public consultation through a public inquiry. However if the investigation commission issues an unfavourable report, the prefect may still grant approval through an administrative order.

The Ministry of Energy grants the electricity operation authorisation. In the case of a tendering process, successful bidders are delivered authorization to operate and no application is required.

In principle, although not common in practice, the public authorities can withdraw authorisation for public interest reasons, subject to indemnification of the holder of the authorisation for the consequences of such withdrawal.

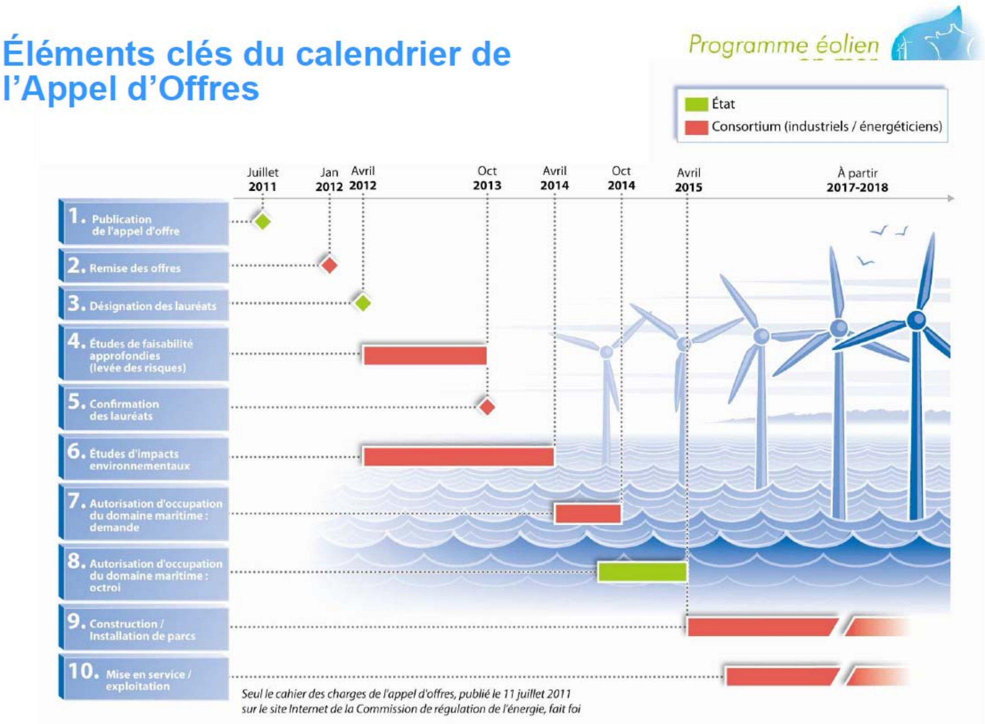
The current consent processes in place cover offshore developments in the French territorial waters. However, there are very little provisions under French law governing the construction of OWFs

[67] Information obtained from CRE
[68] Information obtained from CRE

beyond these waters (i.e. the continental shelf), though a regulatory framework in the EEZ is under consultation[69]. [4] [8] [9]

A.7.5 Project timelines

The bidding process begun on July 2011 and applications can be submitted until January 2012. Although the winning bidder is selected by May/April 2012, a detailed feasibility is implemented before the winner can be confirmed (estimated October 2013). It is expected that a year and a half will then be required to complete the EIA and to apply and obtain the domain concession. Construction is estimated to begin in April 2015 and the commissioning of the first phase of the OWFs in 2018. The figure below provides the anticipated timeline for the project (in French) from the bidding stage to the commissioning of the OWFs.



It is anticipated that the OWF will have to be commissioned in three phases. The selected bidder must commission each phase according to the following timelines:

- Stage 1: bidders undertake to commission at least 20 per cent of the entire power production facility within six years of the notification of the decision by the competent authorities.
- Stage 2: bidders undertake to commission at least 50 per cent of the entire power production facility within seven years of notification of the decision by the competent authorities.

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[69] Information obtained from CRE

- Stage 3: bidders undertake to commission the entire power production facility no later than eight years after the notification of the decision by the competent authorities.

Each stage will have a separate power purchase agreement for a period of 20 years. [4] [7]

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A.8 Sweden

There is currently 130MW of offshore wind in Sweden. There are no OWFs under construction but five OWFs, with a total capacity of 1,075MW, are fully approved and one OWF, with a capacity of 640MW, has been partly approved.

There is strong co-operation amongst the TSOs of the Nordic countries (Sweden, Finland, Norway and Denmark). They also operate a single market for trading electricity through the Nordpool and the regulators cooperate through NordREG. Subsequently there are no barriers from the electricity market perspective to offshore transmission system development between these countries (e.g. between Denmark and Sweden). Sweden is also interconnected to Poland and Germany via HVDC links.

In 2010 Sweden signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding [7].

A.8.1 Transmission assets classification, ownership and O&M

The transmission voltage levels are 220 and 400kV on the national grid. The transmission network is owned by the state through the state-owned utility, SvK. SvK is also the TSO.

How the offshore transmission assets are classified

Generally, generation under 100MW is not connected to 220kV. Generation under 300MW is not connected to 400kV. However, there is one large OWF (110MW) connected at 130kV (regional network level in Sweden), in Lillgrund, developed and owned by Vattenfall [4].

Ownership of offshore transmission assets

In Sweden, the law states that there must be a separate owner (concession holder) for the generator and associated offshore/onshore transmission system (this requirement is independent of the connection voltage level)

A.8.2 Offshore transmission planning

SvK took part in the feasibility study for the connection of the Kriegers Flak, a triple project (potentially 3x600MW) planned on the EEZ borders of Sweden, Germany and Denmark. According to the feasibility study conducted by the three TSOs involved (50Hertz, Energinet.dk and SvK), it is envisaged that the offshore transmission systems from each OWF to the respective countries will be HVDC, with AC interconnections between the three OWFs. Although SvK, the Swedish grid operator, has pulled out due to lack of interest from potential investors in the OWF, the German and Danish projects are still planning to go ahead. It is unlikely that the development will take place in Sweden in the foreseeable future.

A.8.3 Connection process

SvK has developed the "Guidance for the connection of wind power to the grid" [2]. The purpose of the guide is to facilitate wind power project planning. According to the guide the connection process is triggered by application from the generator. However all agreements (connection, construction, operation and transmission use of system) are signed between SvK and a concession holder for a line that interconnects an OWF and SvK's network. The connection application is processed within 12 months. The time to connection is a minimum of 2-2.5 years after signing the connection agreement. If the connection involves building lines that require concession (as a part of network reinforcement) it can take much longer.

SvK can permit the connection of generation to international interconnectors, providing that it does not cause an overload on the international interconnector for more than 5% of the time within a 3 month period. The amount of overload should be higher than a pre-defined level.

A.8.4 User commitment/financial security and transmission charges

SvK funds the costs of the offshore transmission assets and wider network reinforcement costs which are subsequently recovered from the associated transmission system licensee (owner) through the connection charges. The connection changes are determined by the TSO and the generator at the early, planning stage of the process [2].

In early 2009, SvK developed a report on the 'threshold effects', and the disincentives this causes for first generators to connect to the grid [5]. SvK was later commissioned by the Swedish government to transform this report into proposals for amendments that should be brought into law, with the results published in late 2009. This broadly recommended that SvK provide interest-free loans for the 'unclaimed' capacity to the first generator so that payment is only required for their own offshore transmission asset costs. The later generators will pay their own offshore transmission asset costs as required. SvK would be compensated for its capital losses and other costs through an increase on the customer tariff [3]. The proposal is still under discussion.

Transmission network tariff is locational and paid both by the generators (30%) and demand (70%) customers. The tariff consists of two main parts:

- a capacity component, which will cover operation, maintenance and operation of the network; and
- an energy component, which covers the cost of purchasing electricity for losses on the net.

The working agreement is signed annually and these are contained between the Swedish National Grid and network users.

A.8.5 Consenting process

Onshore and within the Swedish territorial waters, the municipalities have a planning monopoly. This means that the municipalities decide on the use of land and the territorial sea within their respective geographical areas. According to planning laws, the municipalities have to make comprehensive plans for the use of land and sea. The Swedish Energy Agency is now responsible for verifying that the municipalities, in collaboration with county authorities, assign enough areas for electricity production in their comprehensive plans for land and sea use. Similarly to TCE in GB, the Energy Agency (regulator) indicates the areas of national interest for wind power development that are particularly suitable for wind power (onshore and offshore). The municipalities take these areas into account in their comprehensive planning.

In order to build wind turbines in the Swedish territorial waters, permits for environmentally hazardous activities and water activities under the Environmental Code (Miljöbalken) are required and the recommendation of the municipality. Permission to establish wind power in the water is granted by the Land and Environmental Court based on an EIA, a consultation with Provincial Board and a recommendation from a local municipality. Note that it is essential for the site to be a within national interest for wind power area in order to obtain necessary consents in Land and Environmental Court. Planning permission is not required for the construction of the OWF where a permit has already been granted. However a notification must be made under the Planning and Building Ordinance. The license is required for the survey of the seabed and the laying of cables for offshore wind power projects in territorial waters. Depending on the circumstances, there may be other laws and processes that need to be taken into account.

Line concession is obtained from the Energy Market Inspectorate. Network concession for the line essentially refers to a line with a fixed route and provides the holder of the concession with the rights to build and operate a line up to certain voltage. A network concession for the line may only be granted if the facility does not conflict with public interests, existing plans or area regulations.

There is no single organisation coordinating the concession processes. However there is a portal (vindlov.se) that provides all the necessary up-to-date information for wind power developers, both onshore and offshore, regarding consenting and beyond [1]. The information is provided by all authorities involved in concession process.

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A.9 Belgium

In Belgium, "The Special institutional Reform Act of 8 August 1980" divides the responsibility of energy matters between the federal government and each of the three regions, Flanders, Wallonia and Brussels. Each of the four authorities has an appointed regulator, with the Commission for Electricity and Gas Regulation (CREG) being the regulating body for the federal authorities.

At present, there are two OWFs in operation with a capacity of 195MW and a further 148MW under construction. There is also 529MW of consented projects. Furthermore is envisaged that Belgium has the potential for installing up to 2,000MW of offshore wind power by 2020.

Although OWFs have been identified by the federal government as the most potential technology for renewable generation in Belgium, there are two major issues that surround these developments.

Firstly constraints within the existing Belgium transmission system limit access to the grid. The Belgium transmission grid had been designed to transport electricity from large centralised plants and, until now, there had been no real need for major transport of energy to and from the coastal areas of Belgium. To address this issue Elia has begun expansion of its 380kV grid between Zomergem and Zeebrugge through the Stevin project. [2] [3] [4]

The second issue surrounding offshore development in Belgium relates to the limited space arising from various conflicting activities at sea. This includes the existence of shipping routes, pipes and cables, nature reserves, naval exercise areas and fishing. [4]

In 2010, Belgium signed the North Seas Countries' Offshore Grid Initiative Memorandum of Understanding.

A.9.1 Transmission assets classification, ownership and O&M

The federal government is responsible for the transmission grid operated by Elia, the TSO. The jurisdiction in offshore renewable generation falls under the federal authority (in accordance with the international maritime law).

How the offshore transmission assets are classified

The onshore and offshore transmission voltages are both classified to be between 150 to 380kV

A.9.2 Connection Process

Any generator wishing to connect to the transmission network in Belgium must submit a request for connection to Elia. Using the information provided by the generator, Elia will then present a proposal for connection (or alteration of connection). A detailed study will then be implemented to determine the technical solution and associated costs. The generator can also request for Elia to conduct an orientation study before the detailed study is carried out. The study will set out technical options for connections and the associated cost estimates.

When both parties agree on a technical solution, a connection contract will be drawn up to specify details on the offshore transmission system and the rights and obligations of both Elia and the connecting generator. The contract contains details on the rights of use, ownership, technical requirement and operation of the offshore transmission system.

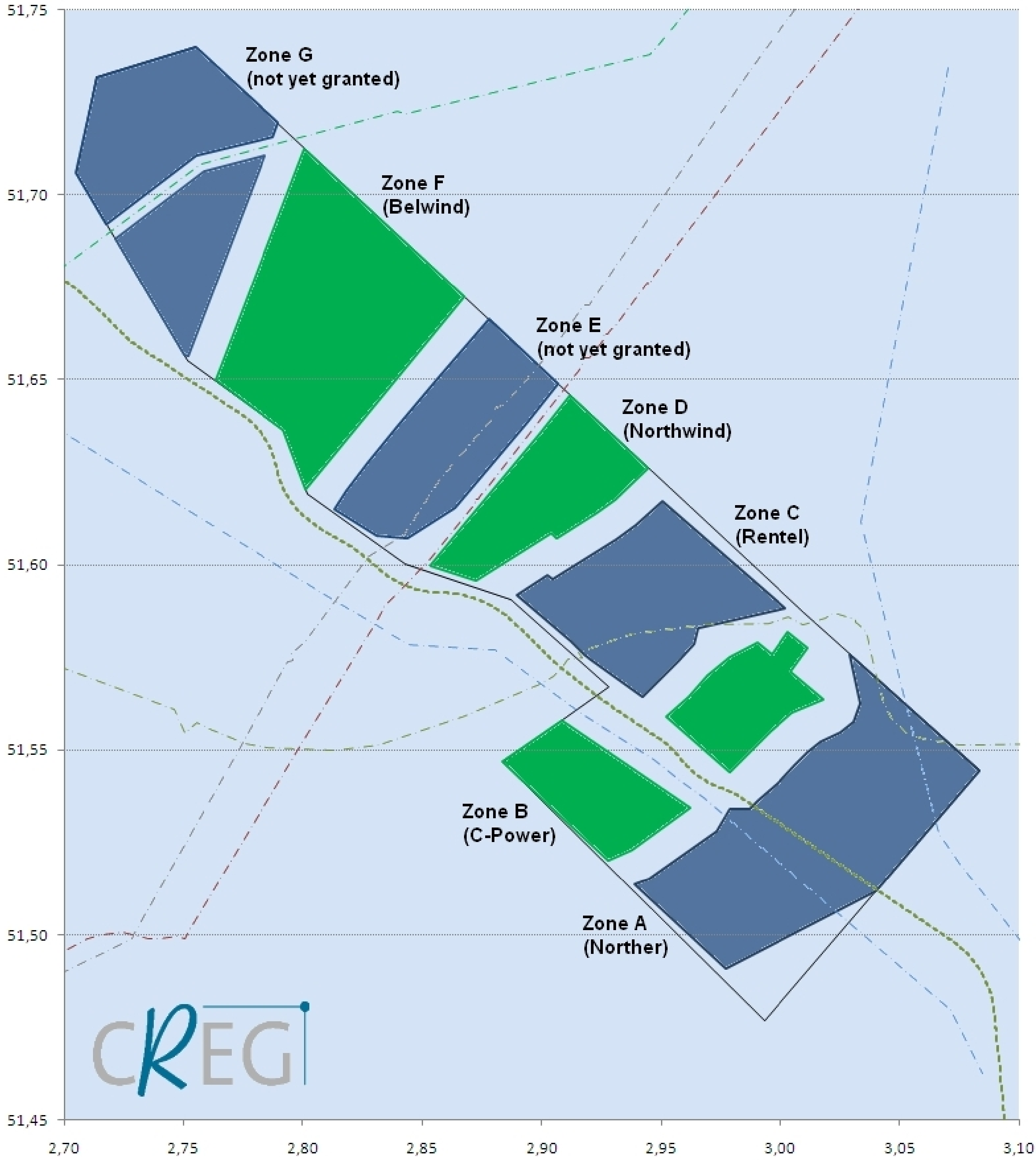
A.9.3 User commitment/financial security and transmission charges

Renewable generators pay for the shallow connections to the grid onshore. However, there is currently some sharing of the costs offshore. The TSO (Elia) finances up to one third the cost of the offshore transmission cable, for a maximum 25 million Euros for a project of 216MW or higher. The funding of 25 million is reduced proportionately if the project is less than 216MW. The cost of the offshore transmission cable includes the purchase, delivery and installation of the submarine cable, the connecting facilities and the equipment and junctions cables between the wind turbines. The TSO's contribution to the connection costs for OWFs is financed by a surcharge applied to the transmission tariffs. Generators do not pay for TNUoS tariffs and therefore all these charges are levied on to the demand customers. [9] [10] [11]

It is not clear if any commitment is required from new generators. It is also not clear whether anticipatory development is or can be supported under the regime.

A.9.4 Consenting Process

An area has been selected for domain concessions that can support up to 2,000MW of wind capacity. To date five domain concessions have been granted. Concession applications have also been made for the remaining zones. The Ministry of Energy of the federal government is responsible for granting domain concession at sea. [5] [6]



- **Figure 22 Domain Concession Zones [10]**

The procedures and conditions for granting such concessions are defined in the "Royal Decree of December 20, 2000". [7]

1) Submission of applications

The application for the domain concession must include the following:

- a general note stating the purpose and description of the project and the forecast for the O&M of the facility;
- the proposed route for the transmission cables for electricity produced from facilities to the onshore connection point;
- a detailed map indicating the locations of the facilities;
- a note containing a description of construction activities, the technical means used for each stage of the activities, the timing of all these activities;
- a technical note describing the characteristics of power generation facilities including, the following information:
  - a) the number of production units;
  - b) the net installed power and reliability of each unit;
  - c) the development plan of the installed capacity of the project, year by year during the term of the concession;
  - d) the site plan, year by year during the term of the concession;
  - e) an estimate of the annual energy produced during the period of the concession, given the development plan of the project;
  - f) characteristics of the offshore transmission system; and
  - g) a statement of how the project contributes to the development of renewable energy in Belgium, given the latest technology; and
- documents needed to assess the financial and economic capacity of the applicant.

2) Application process

Once the application is considered to be complete, it is entered into a register of request for concessions. Within fifteen days, the details of the application, including the subject of the request and location, is published by the Belgium Official Gazette and three other newspapers to cover the entire country at the expense of CREG. Any interested party can then apply to compete on the granting of a domain concession for the same location. The federal Minister of Energy will evaluate the merits of the application and competition, if any, before granting or refusing a domain concession.

Note that if one or more additional permits or approvals are required then the domain concession is suspended until these have been granted or obtained in accordance with the applicable law. If any permits or approvals are refused, the domain concession will expire immediately.

3) Obligations of holders of a domain concession

The obligations of holders of a domain concession include:

- to begin the operational phase of the installation or, where applicable, the demonstration phase of the installation, within three years from the date of notification of the concession or, if later on it, from the date it is given knowledge of the final permit or authorization required under any other legislation; and
- not to stop the operation of a substantial part of the OWF for over a year, without legal reasons, founded technical reasons or force majeure.

4) Application for changes to the domain concession:

Intention to sell, total or partial transfer, sharing and leasing of domain concession must be communicated to the federal Ministry of Energy. The candidate who takes over the concession is subject to the same selection criteria as before.

An EIA and a public consultation is required for every project. A domain concession can be granted before an environmental permit is granted. However, the concession is not valid until the environmental permit is granted. There is also a permit procedure for the installation of the cables (Royal Decree 12 March 2002) [8].

The following federal authorizations are also required: [2]

- a Minister's domain concession granted by the MoE;
- a ministerial authorization of the Federal Environment from the EIA and covering the installation of the OWF, the installation and operation of the cable;
- a ministerial authorization for laying cables at sea provided by MoE; and
- a route permit for laying the underground (onshore) cables is also necessary.

- **Table 16 Average duration of consent processes [9]**

	Average duration of procedure
Domanial concession	1 year
Environmental permits and authorisations	6 months to 1 year
‘Sea cable’ permits	6 months to 1 year
Authorisations for cable-laying along public roads	6 months to 1 year

A.9.5 Current major projects

- C-Power, Thornton Bank (Pilot Phase), 30MW - Commissioned in 2009 [12] [13]
- Belwind, Bligh Bank (Phase 1), 165MW - Commissioned December 2010 [14]
- C-Power, Thornton Bank (Phase 2), 148MW – under construction to be commissioned in 2013 [12] [13]
- Northwind, “Bank zonder Naam”, 216MW – under development [16]

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A.10 China

Currently, China, the world's largest wind power developer with a total of 44,700MW wind turbine installed capacity by the end of 2010, has accelerated the development of offshore wind power. In June 2010, the first stage project of the Shanghai East Sea Bridge OWF went into operation, with a total installed capacity of 102MW. In September 2010 another wind farm, Longyuan Rudong Intertidal demonstration project, 32MW went into operation.

In the second half of 2011, China’s NEB will initiate the second round of offshore wind power concession projects with a total installed capacity of 1,500 to 2,000MW. The public tender for the 1,500-2,000MW offshore concession projects, totalling four OWFs in East China's Jiangsu province, was announced in October 2010. Sinovel, Goldwind and Shanghai Electric turbines will be utilised for this project. The winning prices for these projects ranged between CNY 0.62/kWh and CNY 0.74 /kWh (EUR 0.069-0.082/kWh). These projects have to be finished within three years [2].

■ **Figure 23 Potential for development of offshore wind in China**

China will expand its offshore wind power installed capacity to 5,000MW by 2015 and 30,000MW by 2020, according to the Chinese Renewable Energy Industries Association (CREIA) [1].

Potential offshore wind power in China is estimated to be in excess of 750,000MW (exploitable at a height of 10 meters), much larger than the land-based wind power potential of 253,000MW according to China's Meteorological Administration. Offshore wind development in China remains in the early stages due to complex operating environments for offshore turbines, high technological requirements and construction difficulties [3].

Construction of the world's largest OWF began in late October. The 1,000MW OWF will be located in Bohai Bay, approximately three hours from Beijing, and is expected to be complete by 2020. The Chinese Government has invested USD 2.2b (EUR 1.6b) toward the project, which is being managed by the state-owned China National Offshore Oil Corporation (CNOOC). [4]

In 2009, the Chinese government introduced a feed-in tariff structure for the wind power sector which will apply throughout the entire operational period of an OWF [6]. The feed-in tariff structure has four different categories of tariff, depending on the wind resources of a particular region. These range from CNY 0.51/kWh to CNY 0.61/kWh[70].

A comprehensive nationwide program providing feed-in tariffs for wind projects was launched in August 2009 after several rounds of concession bidding. In the previous concession programs, developers bid for the rights to construct OWFs by submitting a proposal that includes the proposed sale price for the electricity generated. The current comprehensive feed-in tariff schedule for wind has eliminated the need to provide bids on the feed-in tariffs for wind projects on a project-by-project basis. The cost-sharing system is implemented allowing the additional offshore wind power electricity price, which exceeds the benchmark tariff of local coal-fired units, to be covered through national levy as a Renewable Energy tariff [8]. It is compulsory that relevant provisional grid company need to sign a 25-years power purchase agreement (PPA) with the bid winner to purchase all the energy production of the OWF [9].

A.10.1 Transmission assets classification, ownership and O&M

How the transmission assets are classified

Both the onshore and offshore transmission voltages are 220kV, 330kV, 500kV.

A.10.2 Connection Process

The offshore wind energy is close to the areas of high energy consumption in China and therefore no long distance transmission is required. Therefore the grid's limited transmission capacity, a major obstacle from onshore wind energy, is not an issue in the case of offshore wind energy.

China's State Energy Administration (SEA) authorises the provincial level Energy Administration Department (regions and municipalities), where the project has been commissioned, to be

[70] EUR 0.06/kWh and EUR 0.07/kWh, based on a conversion rate of CNY 1 = EUR 0.11 taken on 13/10/11

responsible for offshore wind energy power project completion and acceptance. Upon completion of the civil construction, installation of wind turbines and other facilities, the developer is required to invite the provincial level Energy Administration Department (regions and municipalities) to inspect the completed works. Provincial authorities coordinate and supervise the energy grid companies to complete the offshore transmission system.

A.10.3 Consenting process

SEA and State Oceanic Administration (SOA) jointly issued the Interim Measures on the Administration of Development and Construction of Offshore Wind Energy (the "Measures"). The Measures set out the procedures for: offshore wind energy planning; the procedures and requirements for the grant of development rights; the application and approvals process for project construction and the use of sea space; oceanic environmental protection obligations; construction completion inspection procedures; and ongoing reporting obligations of project developers to the relevant supervising authorities.

The most notable points of the Measures include the following:

- The provincial level Energy Administration Department is responsible for drawing up plans for local offshore wind energy development, whilst the provincial level Oceanic Administration Department provides preliminary opinions on the use of sea space and on a project's impact on oceanic environments.
- The SEA is responsible for national wind energy planning and management and the examination of planning for each province which possesses offshore wind resources. All offshore wind projects will be subject to the approval of the SEA.
- Project developers will be selected from a concession scheme. Bidding, construction design, technological capability and performance record will be the elements affecting the Energy Administration Department's decision.
- Unlike onshore wind energy projects, the Measures rule out the possibility of a wholly-foreign-owned enterprise developing offshore wind energy projects. The Measures provide that "developing and investing companies should be Chinese funded companies or Chinese-controlled joint venture companies (in which the Chinese party holds at least a 50% stake)".
- Financial compensation from the winner of the concession will be awarded to those who fail in the concession process because they have already conducted predatory work for that offshore wind energy project. Such compensation is to be based on the fee standards verified by the Energy Administration Department at the provincial level.
- The right to development will be cancelled if construction of a project is not started within two years after the approval is granted. The right of use for the sea space will be withdrawn by the SOA.

- Project developers are asked to report relevant data, such as operational and meteorological data, to the State Wind Energy Information Centre and the local Energy Administration Departments.

A.10.4 References

[1] Chinese Renewable Energy Industries Association (CREIA) http://www.creia.net/

[2] Offshore wind.biz http://www.offshorewind.biz/2011/04/08/2010-2014-deep-research-report-on-global-and-china-offshore-wind-energy-2/

[3] China Wind Energy Association (CWEA) http://www.cwea.org.cn/

[4] Ernst and Young, “Quick look renewable energy development in China” http://www.renewableenergyworld.com/rea/news/print/article/2010/12/quick-look-renewable-energy-development-in-china

[5] Interim Measures on the Administration of Development and Construction of Offshore Wind Energy http://www.cme.gov.cn/hyfg/fg65.html

[6] NRDC, “Improving China’s Existing Renewable Energy Legal Framework: Lessons from the International and Domestic Experience” http://china.nrdc.org/files/china_nrdc_org/NRDC%20-%20China%20Renewable%20Energy%20Legal%20Framework.pdf

[7] "Offshore wind power development and construction of Interim Measures" http://court.gmw.cn/lawdb/show.php?fid=146421

[8] Introduction of new wind power price National management policies http://www.ndrc.gov.cn/xwfb/t20090724_292578.htm

[9] “Guidebook on Offshore Wind Farm Development in China”, China Meteorological Press

Appendix B Analysis of offshore wind development status in the key countries

In Section 5, Table 1 presents the status of OWF development for the studied countries. The situation varies between the different countries. For example, in the Netherlands, Ireland and Sweden there is currently a lot of approved and planned capacity but nothing under construction. While the regulatory regime for offshore electricity transmission is one of the factors influencing offshore wind power development, there are other significant contributing aspects such as: political support; incentives; certainty in current regime; set timelines for project development; consenting and tendering processes; etc. This appendix seeks to provide an indication of the possible causes for the offshore wind development status in each country, based on the findings of this project and references [1] and [2]. Part of Table 1 is reproduced below (Table 17) and is colour-coded for each row from highest to lowest capacity. The colour-coding aids the analysis provided in Table 18.

- **Table 17 Offshore wind development status**

Country/Category	GB	DE	DK	NL	IE	US	FR	SE	BE	CN
Current Offshore Generation, MW	1,525	120	868	247	25	0	0	130	195	144
Under construction, MW	2,050	400	400	0	0	0	0	0	148	51
Approved, MW	1627	7,235	0	2991	1,595	468	108	1,075	529	0
Planned (Consent application submitted) , MW	1960	10,566	600	719	1,794	3,269	1,455	2,034	N/A	402

High **Low**

▪ **Table 18 Possible causes of OWF development status in the key countries.**

Country / Category	GB	DE	DK	NL	IE	SE
Current Offshore Generation	Political plans for expansion of offshore wind energy, favourable support scheme, tender model for domain concessions, time frames for use/establishment of OWF after award of domain concession.	High investment costs due to long distance to shore and large water depth for suitable locations, long complicated	Sites are chosen by the government and EIA is carried out before tenders for domain concession; attractive feed in tariffs, The TSO is obliged to fund and construct the offshore transmission system,	Round 1 tender process has been successful.	The first OWF was commissioned before the Group Processing Approach was adopted	Insufficient financial incentives and
Under construction	Round 1 scheme (launched in 2000) and Round 2 scheme (launched 2003)	permitting process and responsibility for building long an open issue; .	Anholt OWF Awarded through the last tender was held in July 2010.	It is not an obligation anymore for the suppliers to source generation from renewable sources; difficulty to secure funding for awarded sites. No certainty regarding responsibility for offshore transmission systems.	Currently the only two offshore projects with full development rights did not apply through the Gate	ambiguous regulatory environment
Approved	Currently Round 3 schemes (launched	“Free” connection requires construction to be completed by 2015 Consents that have been applied for long ago are finally coming through	The date for the next tender has not been announced yet. The TSO is obliged to fund and construct the offshore	Consent is required prior to tender for feed-in tariff. Tender Round 3 was expected but didn’t happen	process and therefore face severe delays. The OWFs that receive connection offer through the Gate process don’t have consent yet	The planning and permitting regime related to offshore wind has been
Planned (Consent application submitted)	in 2007) are all in the planning stages	“Free” connection requires construction to be completed by 2015 After 2015 the Feed in tariff decreases 5% each year For a number of sites conflicting applications were lodged [2]	transmission system for the sites chosen by the government and awarded through the tender process. Open door applications are possible but unlikely due to higher project costs.	It was not clear if further tendering Rounds will be held. It is likely that the consents will expire before development commences.	Lack of political commitment in terms of development targets and lack of coordination between principal framework elements of consent, connection to the grid and financing.	favourable compared to many other countries for projects in the EEZ [2].

The analysis of the offshore wind power development status in the remaining countries is summarised below.

Belgium: Constraints from the limited capacity of the grid and limited marine space for OWFs. High fixed subsidy for the first OWFs explains current status of offshore wind in Belgium. Substantially lower subsidy past the first 216MW of offshore wind explains a sudden halt in the development.

France: The development of offshore wind energy is in its early stages and therefore there is no development to date. Tender process has only recently begun (July 2011). RTE will be responsible for financing and construction of the offshore transmission system with the cost recovered via connection tariffs. This explains the number of OWFs approved and seeking consent.

USA: OWF development is in early stages and hence no OWFs has been built to date. This might be attributed to: varying levels of incentives and renewable targets between the states; and that the offshore environment is more challenging than in Europe. Recent developments on the consenting procedure by BOEMRE has resulted in increased number of consented applications.

China: China is in the early stages for OWF development. One commercial OWF is built to date. The public tender for the 1,500-2,000MW offshore concession projects, totalling four OWFs in East China's Jiangsu province, was announced in October 2010. The second round is only launching in the second half of 2011.

Appendix C Further Details of Consenting Process in GB, Germany and Denmark

In Section 6.1.7, Figure 16 provides the overview of the consenting process in the key countries; Table 19 provides further details on the consenting process in GB, Germany and Denmark.

- **Table 19 Consenting process in GB, Germany and Denmark**

Country / Category	GB	DE	DK
Are there any barriers from the consenting process for the sharing of assets?	There is currently a need for holistic planning applications that take future generation demand into account. Associated development is only granted if necessary for the development for which the consent is being sought	No, network operator is responsible for consenting. There is a procedure when to start consenting to ensure that it is for the approximately correct capacity.	No, since system operator is responsible for obtaining consent for offshore transmission system, but coordination between the projects is not envisaged
Bodies involved in the consenting process or coordinating it?	1 – 100MW MMO (England) and Welsh Government (Wales); >100MW IPC (Engl. and Wales); Marine Scotland (Scotland);	Maritime and Hydrology Agency (BSH), local (Länder) authority, Ministries for Economic Affairs and the Environment Ministries. Offshore Wind Commission of the Federal Government and the Coastal States (StAO-Wind) is coordinating body	DEA is coordinating consenting process (one stop shop approach)
Who and what triggers consent process?	OFTO or Developer/Generator	TSO, after genererators to be connected fulfil several criteria including consents for WFs	Developer that won a tender for the particular site. Sites are decided by the Government, EIA for the site and offshore transmission system is done before the call for tender.
Can consent be initiated by one party on behalf of another?	yes	no	no
Can consent be initiated when the ultimate owner is not known?	yes	no	no
Can consents be split or transferred ?	yes	no	no

Country / Category	GB	DE	DK
What is required on the consenting process?	Onshore elements require planning permission, offshore elements requiring a marine license, subject to EIA. Other consents may be required on the project by project basis, see overview	Main Inspection Report by Federal Marintime and Hydrology Agency. Building permit from the local Länder authority onshore	To establish an offshore transmission system Energinet.dk has to seek a concession from DEA
Can additional capacity be provided for undefined future projects?	No	The platform can be build in anticipation of the future project. Then when and if the capacity is needed additional cables will be layed down and for this new consent will be needed.	no
Can multiple options be consented?	Yes, as part of the 'Rochdale Envelope'	Not clear	no
What level of compatibility exists with the coordinated network with planning process, compulsory purchase and easements	Theoretically compatible but no incentives for coordination	Compatible.	theoretically compatible since one body responsible for the offshore transmission system
Comments			Offshore developments are considered project by project no consideration of coordination