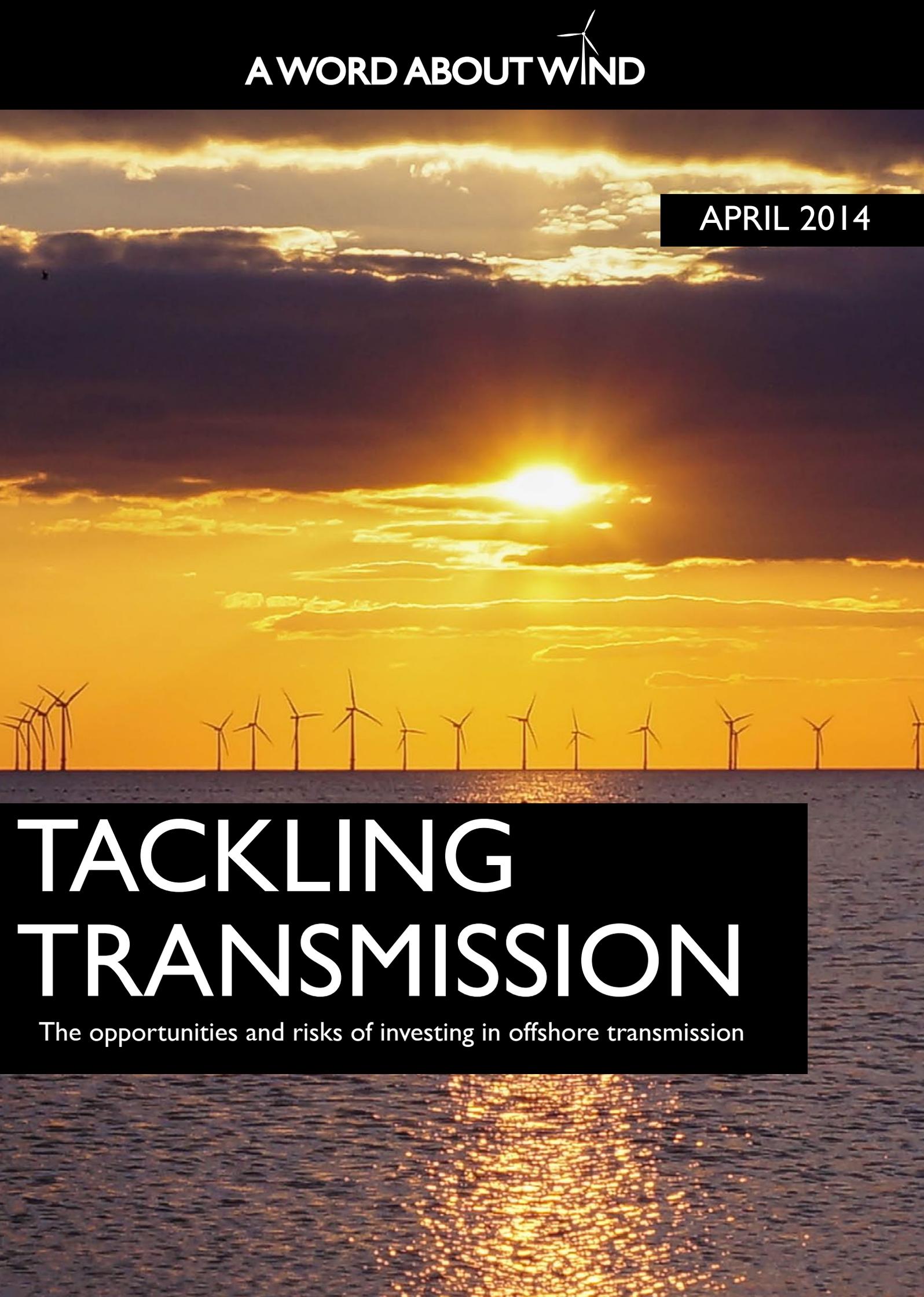


APRIL 2014

A photograph of an offshore wind farm at sunset. The sun is low on the horizon, creating a bright orange and yellow glow across the sky and reflecting on the water. The silhouettes of several wind turbines are visible against the bright sky.

TACKLING TRANSMISSION

The opportunities and risks of investing in offshore transmission

CONTENTS

Offshore wind: End of the offshore gold rush	4
Opinion: Chris Veal, Transmission Investment LLP	6
The UK: Understanding the OFTO regime	7
Opinion: Stewart Orrell, Balfour Beatty Investments	11
Germany: Industry tackles transmission delays	12
Opinion: Charles Yates, Grant Thornton	15
Unexploded bombs: Projects face munitions risk	16
Opinion: Barry Howarth, Subsea & Offshore Solutions Ltd.	19
Emerging markets: China, Japan, the US and more	20

A Word About Wind
www.awordaboutwind.com
editorial@awordaboutwind.com
 T: +44 (0)20 7193 6013
 +1 (917) 310 3307

2nd Floor,
 167-169 Great Portland Street,
 London, W1W 5PF

Editor: Richard Heap
 Designer: Lee Washington
 Publisher: Adam Barber

Cover image: Bev Goodwin



EDITORIAL

by Richard Heap, editor at A Word About Wind

For those of us in Europe it is easy to forget how far ahead we are in terms of offshore wind. Other parts of the world may have ambitions offshore, but Europe dominates.

The facts bear this out. Globally, the UK, Denmark and Germany have the most installed offshore wind capacity; and the most developed networks to connect offshore projects to the grids.

The result is that opportunities to invest in transmission networks are also concentrated in Europe. The UK has its Offshore Transmission Owner (OFTO) regime, which has attracted institutions to invest in wind farm export cables. Opportunities have also arisen in Germany due to shortages in the funding needed to develop these links. But, beyond these, investment opportunities are still few.

This is unlikely to change in the near future. Countries around the world are talking about plans to develop their offshore wind market, particularly in Asia and the US. But there is a big difference between talking about developing these networks and doing it. Some of these nations have small developments or pilot projects, but nothing of a significant scale.

And investors won't necessarily get the chance to buy transmission assets even if there is growth in these markets. Grid operators in China and South Korea don't need the money; and the US market is already gaining interest from giants such as Google. That is stiff competition.

Developers, contractors and manufacturers in Europe are aware of the practical difficulties of developing transmission links. That is knowledge they can export to the world.

Buying transmission assets may be an opportunity in the long-term. But, in the short-term, it would be best for transmission experts in Europe to focus on what they can sell in these emerging markets.

Getting energy from an offshore wind farm to the onshore grid is not an easy process. Developers, contractors and manufacturers in Europe are aware of the practical difficulties, and that is knowledge they can export to the world.

For example, companies in Germany are working through a lot of financial and technical issues that have arisen because

the country is developing offshore wind farms in clusters; and because existing grid operators have been landed with the responsibility of developing these links. Firms can sell that expertise to people who don't want to repeat mistakes that have been made elsewhere.

Meanwhile, the OFTO regime provides a model for how countries can attract institutional investment in transmission links. This could work both offshore and onshore; and so firms who have worked in this regime have knowledge to impart.

Building transmission links is not simple. It makes sense for businesses to sell knowledge about how to do so, even if they can't own part of another country's offshore grid. This is an emerging discipline and there's money to be made. ■

Tackling Transmission is the first of five special reports we will publish in 2014. For more information about our special reports programme, please get in touch.

You can call me on the number by the contents section above, or email me at: richard@awordaboutwind.com

And thanks for reading.



Focussed on power transmission

Robust and cost-effective electrical systems are critical for the delivery of reliable power which in turn determines the revenue, profitability and viability of power generation projects.

TÜV SÜD PMSS provides expert independent advice to optimise electrical infrastructure and maximise return on investment, drawn from two decades of front-line experience. Our industry experts deliver a complete range of solutions from network connection feasibility, to device grid compatibility, power loss and load flow analysis.



For further information please contact
Angus Young
pmss@tuv-sud.co.uk | +44 1794 526 560
www.tuv-sud.co.uk/transmission

END OF THE GOLD RUSH

Fast offshore wind growth is giving way to more measured expansion as countries including the UK and Germany rein in green subsidies.

Developers have spent the last decade trying to profit in wind-rich parts of northern Europe. They have been supported by governments keen to embrace green energy.

But governments that have presided over this offshore wind gold rush are increasingly pushing for the sector to grow without such supportive subsidies.

Europe currently dominates the offshore wind market. More than 90% of the world's offshore wind power is in the waters of northern Europe; and most of the rest is in two demonstration projects off China's east coast.

The opportunity to invest in transmission is most developed in the UK, with its OFTOs. Few others come close.

This dominance means companies operating in Europe are well-placed to sell their knowledge about developing offshore wind networks to countries with burgeoning offshore markets.

The UK has almost 3.7GW of offshore wind projects installed in its waters (see table), which is more capacity than the rest of the world combined.

The UK's position also means it has arguably the world's most developed offshore wind network, with Germany and Denmark its closest rivals. As a result, the opportunity to invest in transmission is also most developed in the UK, with its Offshore Transmission Owner (OFTO) regime (see p.7). Few others come close.

Opportunities to invest in new offshore transmission links can only exist where offshore wind farms are being built. That

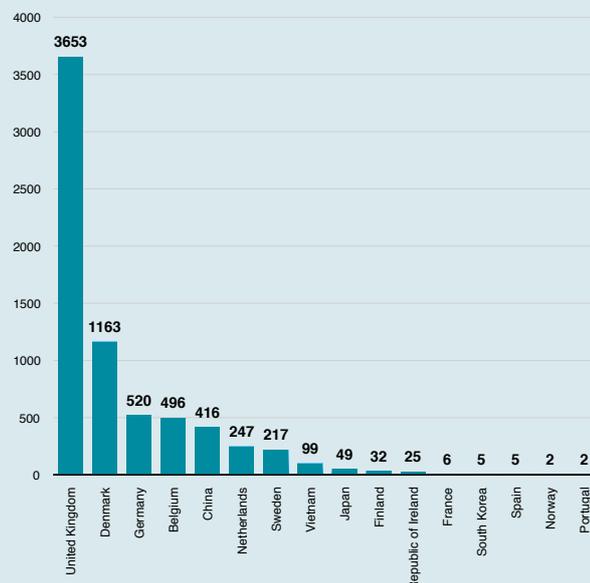
means Europe. However, in Europe, there are big questions about whether offshore wind projects will continue to be built at the fast rate they have over the last decade (see EWEA box, p.5).

Policy uncertainty

Governments in countries that are leading on offshore wind are rolling back on policies that support renewables. Those in the UK and Germany are likely to re-

Total offshore capacity by country

Source: The Wind Power, March 2014



member 2014 as a year when governments tilted the energy market back in favour of traditional power generation.

Countries with burgeoning renewable energy sectors are grappling with the extra costs of subsidies for consumers.

Last month, UK chancellor George Osborne announced in his 2014 Budget that the government would freeze the carbon price floor at £18 a ton from 2016.

The carbon price floor came into force last year as a top-up tax on fossil fuels used to generate electricity. One of its aims was to boost spending on renewable energy projects, but the freeze has thrown that into question. Trade body RenewableUK has said investments worth £4bn, including in offshore wind, are now at risk.

Things are little better in Germany. This month, its government is set to finalise details of reforms to the Renewable Energy Sources Act, which pays generous incentives to renewable energy producers and priority access to the grid.

The act has boosted the renewables sector and been instrumental in helping the country to gain 25% of energy from renewables last year. But the government is concerned about the effect it is having on consumers and traditional energy producers. These proposed reforms are due to come into force in August.

Neither the UK or Germany is likely to change course significantly in the next couple of years. The German coalition was formed in November 2013 so has a popular mandate; and the UK government is now gearing up for a general election in May 2015, so major incentives for renewables look unlikely.

EU-wide target delays

Meanwhile, the European Union has delayed announcing tough new renewable energy targets for European nations. The EU is considering a target that 27% of European energy should come from renewables by 2030, but industry experts called this “unambitious”. EU leaders are set to debate this in the autumn.

So countries with burgeoning renewable energy sectors are now grappling with the extra costs that subsidies are putting

The market in numbers: European offshore wind

In January, the European Wind Energy Association (EWEA) published its *European Offshore Statistics 2013* report, which shows how far European offshore wind has grown.

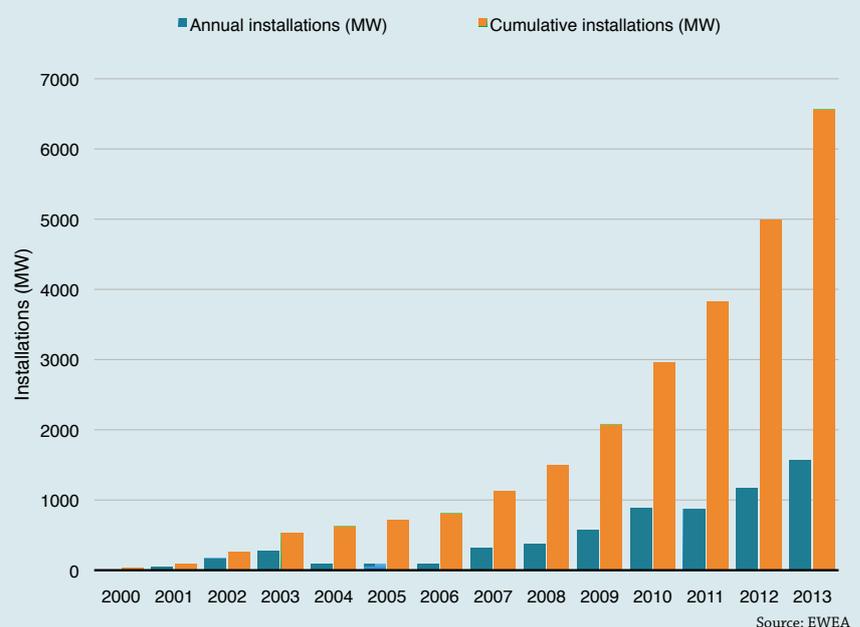
Total installed offshore wind capacity in Europe was 6.6GW at the end of 2013 (see graph). EWEA expects growth to continue, with 3GW due to come online in the coming years.

This shows that offshore wind in Europe will present opportunities for investors in 2014 and 2015. The report also shows the growing importance of transmission deals, which accounted for 41% of Europe’s major offshore deals in 2013 by deal value.

This partly reflects the lower number of European wind farms that reached financial close last year. Two non-recourse financings for landmark projects reached financial close in 2013: the £937m (£776m) refinancing of the 288MW Butendiek project in Germany; and the £266m refinancing of Masdar’s minority stake in the 630MW London Array.

In transmission, three OFTO deals were completed in 2013. Two involved the sale and the non-recourse financing of offshore cables at Sheringham Shoal (£190m) and London Array (£230m); and the third revolved around a bond issue, at Greater Gabbard (£305m). ■

The growth of European offshore 2000-2013



on consumers’ energy bills. This means the policy outlook for European offshore wind is not benign, and we expect growth to be slower than previous forecasts.

For example, the European Wind Energy Association has a target for offshore wind in Europe to hit capacity of 40GW by 2020. That is very ambitious given both government policies and the technical challenges of building wind farms bigger and further offshore.

Developer-led opportunities

But let’s not get too negative. Developers are still working on big plans. Major offshore projects due to come online this year include the 576MW Gwynt y Mor wind farm, off the coast of north Wales, by RWE. Chances to invest in offshore transmission networks will continue to arise as long as such projects progress.

Outside Europe, growth of offshore wind is patchy. Economic heavyweights such as China, India, Japan and the US are looking at the sector, but their plans are still embryonic and not at a stage where outside investors would be able to invest in transmission. In countries like China where the grid is in the hands of a cash-rich state-run entity, that chance to invest in transmission is unlikely to arise.

Even so, opportunities will still exist in those countries for firms with expertise in transmission networks. Companies working in offshore wind in Europe have been through the pain of setting up offshore wind farms and their grid links. The wealth of knowledge there is growing and can be sold to others.

Buying transmission assets may not be an option — but selling transmission knowledge could well be. ■



Chris Veal is managing partner at Transmission Investment LLP

EUROPE'S TRANSMISSION INVESTMENT PROSPECTS

British regulator Ofgem has led the way in Europe in attracting new and competitive sources of investment into electricity transmission. More countries should look to follow its lead.

To date, £2.5bn of offshore transmission assets have been tendered and deals totalling £1.4bn have closed. The National Audit Office estimates that there is potential for a further £8bn of investment in British offshore transmission by 2020.

As well as reducing the cost of capital required to finance these transmission assets, new investors have brought transparency to the costs needed to repair and maintain them; and done so with no loss of performance. To date, availability of these privately held assets has been well over 99%.

This track record provides Ofgem with a benchmark against which to assess the opportunities for introducing competition into the delivery of other transmission assets — both onshore and offshore — that were hith-

erto reserved to the incumbent monopoly transmission companies.

Outside Europe, countries like Brazil, Chile and the US have a long history of competitively delivered transmission. Projects that have been competitively tendered include the Rio Madeira transmission link in Brazil, the world's longest overhead line. Competitive approaches can handle even the most challenging developments.

Back in Europe, the biggest need for capital investment in recent years has been driven by offshore wind but, to date, no other regulator has followed Ofgem's lead.

The two most significant capital programmes in Europe for the connection of offshore wind farms are in the UK and the German North Sea. Whilst the British approach has allowed offshore wind developers to build the assets before bringing in the new investors, the German approach has required the incumbent transmission owner TenneT to deliver the connections.

The German approach has not been as successful as the British. There have been significant delays to most projects, and TenneT has been put under considerable financial stress. The cost of these delays to German consumers is not yet clear.

But, in any event, it does seem time for the German and other European regulators to propose an alternative model.

The move to a low carbon economy over the next 30 years will inevitably mean a continuing shift from the use of fossil fuels to renewables and other forms of low carbon energy. This will require significant capital investment not only in generation but also in transmission — and the Ofgem model can attract that investment.

It can also introduce much-needed competition. Affordability of electricity will remain a key issue if Europe is to remain competitive, and encouraging competition in the delivery of transmission is one way to help make electricity more affordable. ■

www.fichtner.co.uk

+44 (0) 161 476 0032

FICHTNER

Consulting Engineers Limited

Fichtner is at the forefront of the global expansion within renewable energy market. Our team is involved in the development and construction of a wide range of new technologies and the transformation of grid infrastructures in any countries. Our Specialist Offshore Transmission Services include:

- Power Transmission & Distribution – HV, MV, LV, EHV,
- Networks & Network Operation
- Electrical Engineering
- Power System Studies
- Feasibility studies and optioneering analysis
- HVDC technology assessment
- HVDC/ AC system design
- Specifications and procurement
- Owners/ Lenders Engineer services
- Due Diligence
- Grid Connection and compliance studies
- Offshore & Onshore substation design
- Converter station design
- Inter-array cabling
- Instrumentation & Automation Engineering (SCADA)



For further information on our project references or a more detailed discussion on our services please contact: Duncan Abernethy, Business Development Director, duncanabernethy@fichtner.co.uk





MAKING THE RIGHT CONNECTIONS

Sheringham Shoal by HND-INFO via Flickr

The OFTO regime has successfully attracted investors to help fund the development of UK offshore transmission assets, but it still has flaws.

Don't invest in something you don't understand. It is an old adage for investors, but one that might explain why so few firms have had the confidence to invest in offshore transmission links.

The Offshore Transmission Owner (OFTO) regime is a child compared to other asset classes, and this year it celebrates its fifth birthday. Best practices for how to connect offshore wind farms to the onshore grid are still in their infancy; and nobody has practical experience of managing one for a 20-year investment period. Reticence among some investors is to be expected.

The regime is also gaining criticism for putting wind farm owners at too much risk once the control over the transmission link has shifted to the OFTO.

Even so, the regime is continuing to attract investors. Deals on three projects totalling over 1.1GW are expected to reach financial close this year; and regulator Ofgem started the tender process for two more of these links in February. The system may not be perfect, but at

least the government has succeeded in getting something up and running. Ten years ago it was only a concept.

The growth of OFTOs

The government started consulting on the design of OFTOs in 2005, based on powers in the Energy Act 2004; and it came into force in 2009 under the control of regulator Ofgem and the Department for Energy and Climate Change (DECC).

The OFTO regime is a child compared to other asset classes and this year it celebrates its fifth birthday. Reticence among some investors is to be expected.

The key principle of this regime is that the wind farm and the grid connection must be in different ownership.

The idea underpinning this approach is that opening up the transmission market to new investors should lead to more competition and raise the quality of service in offshore transmission. Ultimately, the aim of the government and Ofgem is

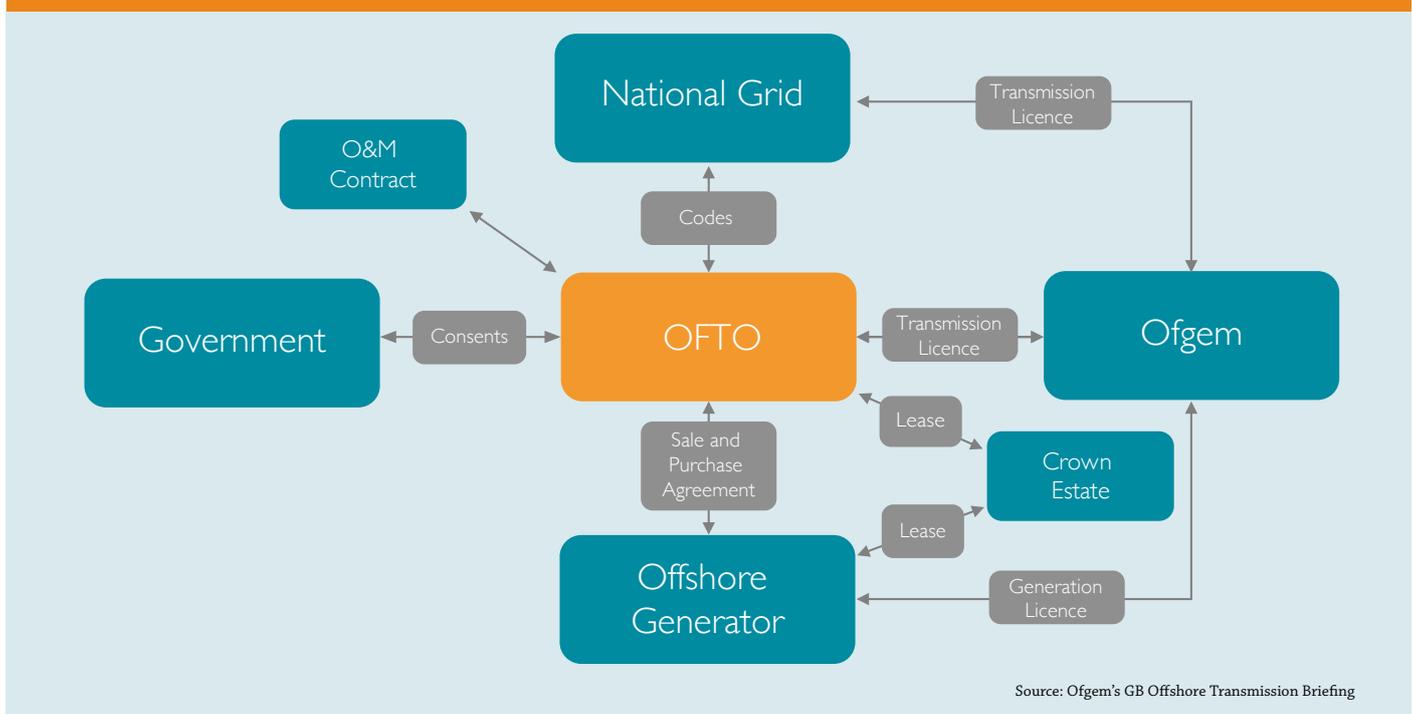
to reduce costs for consumers; although the Public Accounts Committee did criticise the lack of competition in the regime in January 2013.

Even so, this is not how the government initially planned the regime. DECC's initial idea was that the OFTO company would design and build offshore transmission links, as well as financing, operating and owning them.

This idea did not find favour with developers, who argued that this would make it tough for the wind farm developer and the transmission developer to coincide their construction timetables; and would reduce the appetite of companies to build offshore wind farms. If a business builds a wind farm then they want to know they'll be able to connect it to the grid. That's a fair demand.

This forced Ofgem and DECC into a rethink, and in August 2010 they revealed they were looking at an idea called "generator build". Here, the wind farm developer also builds the transmission link. That link is then sold on to the OFTO. This system gives the developer more

The OFTO Investment Structure



certainty that they will be able to connect their wind farm to the grid when their development reaches completion. This regime took effect on 31 December 2010 and is the basis of the system that is still in force today.

This regime has been successful in some respects. It has brought new investors into UK offshore transmission, although three big names dominate (see table, p.9): Transmission Capital Partners has won four OFTO licences and been named preferred bidder on the 270MW Lincs project; Barclays-led consortium Blue Transmission has won four; and Green Energy Transmission, led by Balfour Beatty Investments, has won one licence and been named preferred bidder on two.

Attracting investors

The system is also becoming more financially innovative. In November, the Greater Gabbard OFTO was the latest to reach financial close and the first funded using bonds, with £305m issued.

Andrew Gallagher, partner in the infrastructure team at law firm Hogan Lovells, says the use of bonds was a big departure for the regime: "Until the middle of last year, long-term bank debt was the only solution that investors could use to comply with OFTO tender rules."

Green Energy Transmission, the winning OFTO at Greater Gabbard, is due to reach financial close in 2014 on the two other OFTO deals where it has been named

preferred bidder: the £346m deal at Gwylt y Mor and the £163m deal at Thanet.

Min Zhu, associate director of offshore transmission at Ofgem, says the use of bond funding at Greater Gabbard was only possible because investors are becoming more confident in the sector.

She says: "A mature regime was one of the pre-requisites for making bond funding viable. The fact that Greater Gabbard OFTO was able to successfully launch a public bond issue demonstrates that there are a range of investors willing to invest in OFTO who have not previously invested."

"You have to be aggressive to win these assets. It would probably be helpful for the market if there were new entrants, but it is very competitive amongst the three who tend to get shortlisted."

Ofgem hopes to see more innovation in the round three tenders, launched on 26 February, for the links to E.On's 220MW Humber Gateway and Dong Energy's 205MW Westermost Rough. On the latter project, Dong agreed to sell 25% each to Japan's Marubeni and the UK's Green Investment Bank on 31 March.

Experienced OFTO investors say the round three launch event was well attended, but we will only see when the

bids come in if this interest results in a new owner entering the market. It is not an easy market to break into.

As for funding types, existing OFTO companies and new bidders will continue to choose whichever funding mechanisms are most competitively priced. Bonds are set to be the favoured option for funding OFTO deals in the short-term because it costs less to borrow than with other forms of financing.

Mark Dooley, senior managing director at Macquarie Capital, says the biggest challenge for would-be investors getting into the sector is that it requires specialist knowledge, especially on how to price risk. Macquarie Capital has acted as financial adviser to the Blue Transmission consortium on all of its OFTO deals, and as an equity investor in three of them.

He says: "When you combine that [need for specialist knowledge] with the fact that the market has matured very quickly, you have to be aggressive to win these assets. They're also quite expensive to bid for. For the market, it would probably be helpful if there were new entrants, but I can assure you that it is very competitive amongst the three people who tend to get shortlisted."

Even so, he says the OFTO regime has helped to achieve a cheaper cost of capital to build transmission assets than the utilities typically achieve. Dooley adds that it would be easier for new investors to get into the market if the concept of

OFTOs so far: Winners and preferred bidders

	Project name	Developer	Size	OFTO transfer value	Annual revenue	Bid status	Offshore Transmission Owner
Round 1	Robin Rigg East and West	E.On Climate & Renewables	180MW	£65.5m	£6.5m	Licence granted (02.03.11)	Transmission Capital Partners (consortium of Transmission Investment, International Public Partnerships and Amber Infrastructure Group)
	Gunfleet Sands 1 and 2	Dong Energy	173MW	£49.5m	£6.0m	Licence granted (19.07.11)	Transmission Capital Partners
	Barrow	Dong Energy and Centrica	90MW	£33.6m	£4.8m	Licence granted (27.09.11)	Transmission Capital Partners
	Walney 1	Dong Energy, SSE and OPW	184MW	£105.4m	£11.0m	Licence granted (21.10.11)	Blue Transmission (consortium of Barclays Infrastructure Funds Management and Mitsubishi)
	Ormonde	Vattenfall	150MW	£103.9m	£10.6m	Licence granted (10.07.12)	Transmission Capital Partners
	Walney 2	Dong Energy, SSE and OPW	184MW	£109.8m	£11.8m	Licence granted (26.09.12)	Blue Transmission
	Sheringham Shoal	Statoil and Statkraft	315MW	£193.1m	£17.9m	Licence granted (27.06.13)	Blue Transmission
	Greater Gabbard	SSE and RWE Npower	504MW	£317.1m	£24.8m	Licence granted (26.11.13)	Green Energy Transmission (consortium of Balfour Beatty Investments, Equitix and AMP Capital)
	Thanet	Vattenfall	300MW	£163.1m*	n/a	Preferred bidder appointed	n/a (preferred bidder is Green Energy Transmission)
Round 2	Lincs	Centrica and Dong Energy	270MW	£281.6m*	n/a	Preferred bidder appointed	n/a (preferred bidder is Transmission Capital Partners)
	London Array	Dong Energy, E.On and Masdar	630MW	£459.0m	£35.0m	Licence granted (10.09.13)	Blue Transmission
	Gwynt y Mor	RWE Innogy, Stadewerke München and Siemens	576MW	£346.0m*	n/a	Preferred bidder appointed	n/a (preferred bidder is Green Energy Transmission)
	West of Duddon Sands	Scottish Power and Dong Energy	389MW	£311.0m*	n/a	Invitation to tender stage	n/a
Round 3	Humber Gateway	E.On Climate & Renewables	220MW	tbc	n/a	Tender launched 26.02.14	n/a
	Westernmost Rough	Dong Energy, Marubeni and UK Green Investment Bank	205MW	tbc	n/a	Tender launched 26.02.14	n/a

* Estimated transfer value

Source: Ofgem / additional research by A Word about Wind

“OFTO build” takes off. In this model, the OFTO owner would build the transmission asset as well as manage it, and this would open opportunities for established infrastructure firms.

The idea has not taken off so far because wind farm developers would rather build the transmission link themselves, so they know it will be ready on time, and built to the specification they require.

In theory, the concept of “OFTO build” should be similar to approaches to project delivery that are well established in the world of public private partnerships and private finance initiative deals.

Dooley says: “If the market gets the opportunity to deliver “OFTO build”, they will do a very good job of it. The question is whether there will ever be a wind park developer who makes the choice to split or reduce his capital target and his responsibility for building the link, and entrust that to a third party... Hopefully, one day soon, someone will say they’re happy for someone to conduct the OFTO build independent of the wind park build, but nobody has done that yet.”

Evidently then, there are reasons to be positive about how the OFTO regime is evolving. It has attracted new money to the sector, resulted in a low cost of borrowing, and has established a model that the industry can continue to build on.

It could also provide a model that grid operators could use to attract more investment in the onshore grid. There is no reason why it should only work offshore.

Even so, the system does have flaws.

Risky business

The biggest of these is the way risk is apportioned. The risk for the OFTO owner is low, and this is why the regime is able to attract institutional investors who can fund deals at low interest rates.

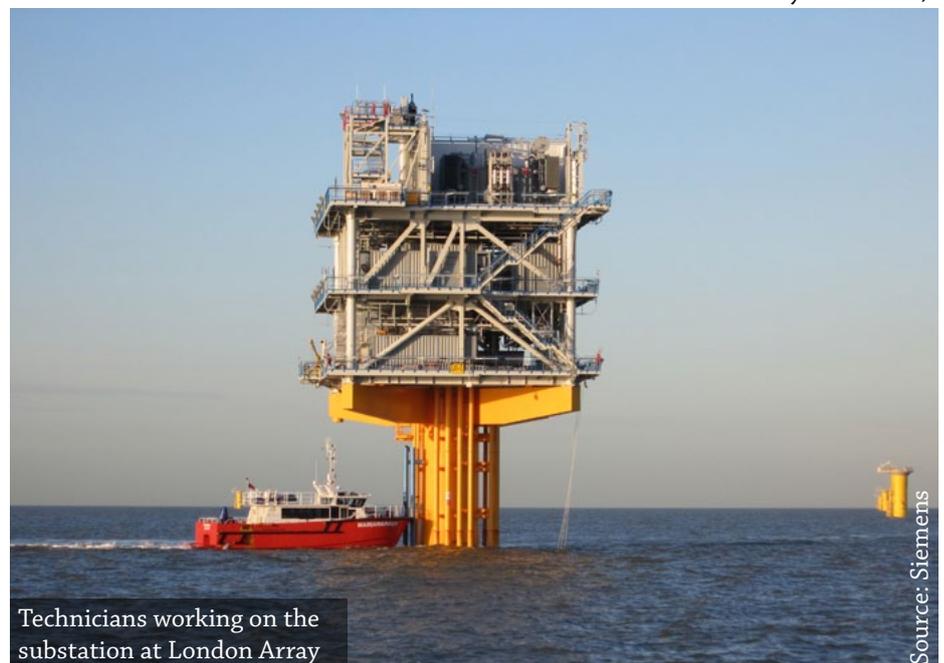
The risk for the wind farm owner, on the other hand, is much higher because it is reliant on a transmission link working properly but has no direct control over how that link is managed or maintained. Wind farm developers don’t want to be in a situation where they have a wind farm but cannot connect it to the grid.

The big challenge for OFTO investors is to understand the asset they own and how to best to manage it.

The “generator build” model has cut the risk of an offshore wind farm being built with no connection to the grid; but the developer is still at risk when the wind farm is up and running. The wind farm owner has a lot of money resting on whether the project is online, but no direct control over the transmission link. If the OFTO experiences problems with its link, the wind farm operator suffers.

Matthew Knight, director of business developer for UK offshore wind at Siemens Energy, says wind farm operators have raised this concern but he does not expect this aspect of the regime to change significantly. The current structure has been years in the making.

“Some of the politicians... and some of the senior staff at Ofgem have invested a lot in the OFTO regime, and it is hard for them to un-do what they have done,”



Technicians working on the substation at London Array

Source: Siemens

he says. “Changing your mind, even for a good reason, is always represented in the press as a U-turn and that they got it wrong.”

Knight says a big challenge for OFTO investors is to understand the asset they own and how to manage it. This is a new industry with fewer than 30 offshore substations in the world, of which all have been built in the last decade, and so industry standards are in their infancy.

“If there’s a problem with the grid connection it tends to mean the whole wind farm is offline.”

For example, he says all parts of the wind industry tend to underestimate the difficulties posed by the weather.

“In this last winter, we’ve had wind farms with 60%-70% weather downtime, so you can only get to them three days out of ten,” he says. “If there’s a problem with the grid connection it tends to mean the whole wind farm is offline. The risks are all about understanding what you’ve got, what it takes to get out there and back, and what you can do remotely to run it.”

New investors in this fledgling sector need to understand the risks in order to manage them; and the sector is yet to understand the whole-life costs of operating a transmission link.

The £8bn ambition

Even so, the investment opportunity is there. The UK government forecasts UK offshore capacity - which is currently 3.6GW - could grow to 18GW by 2020, and all new projects would need grid connections that would be held in an OFTO. The National Audit Office estimates there is potential for further OFTO investment worth £8bn by 2020.

This raises the question about whether there would be enough capital available in the market to fund these deals.

Ofgem and DECC are looking to open up the OFTO regime to new investors and new funding mechanisms, but it is difficult to predict whether this will succeed. Other funding may be needed.

Christine Brockwell, managing director of UK offshore wind at the Green Investment Bank, says the bank is monitoring

whether there would be enough capital in the market to invest in OFTOs. She says the bank could step in if a funding gap emerges.

“By investing on commercial terms, rather than providing soft money, we can demonstrate to the market that the risk profile and investment returns are appropriate and ‘crowd in’ additional capital. This is what we have been doing in developing a secondary market in operating generation assets,” she says.

Investing in transmission links would help the bank ensure that offshore wind projects are built; although the use of bonds in the Greater Gabbard deal suggests that more investors will be attracted to the sector and that a funding gap won’t be a problem. It shows there is interest in OFTOs from investors beyond the current “big three”.

However, the regime doesn’t exist in a void, and it would only take a change in the financial markets or the structure of the regime to put off potential investors.

Six years ago this regime didn’t exist. A lot can change in the next six. ■



DNV GL experience:

- 90% of the world’s utility-scale offshore wind projects
- 97% of operating megawatts
- More than 30 years in wind energy
- Full-scale lifecycle services
- Best practices to minimise risk and manage cost

To learn more, visit www.dnvgl.com/renewables or www.dnvgl.com/renewables-certification



Stewart Orrell is managing director of economic infrastructure at Balfour Beatty Investments

OFTOS: GREEN POWER TO THE PEOPLE

This is a substantial scheme and it's changing the blueprint of the UK's national power supply, encouraging investment in renewable electricity generation to meet an ever increasing demand."

So said George Balfour in 1922, when we first got involved in the renewable energy market. Back then hydroelectricity was revolutionising power generation, and we were at the forefront. Construction of the Grampian scheme in Scotland (completed in 1930) was the first hydroelectric project designed to supply power to the public. It was an engineering triumph and in later years we installed the UK-France interconnector and subsea transmission links to many of the Scottish Isles and more.

Developing and delivering power transmission systems is a core aspect of what we do. So, when Ofgem announced its ambitious plans for the Offshore Transmission Owner (OFTO) regime, it was an opportunity that we wanted to be a part of.

Ofgem's challenge was substantial: it had to engineer the best outcome for consumers while managing a new and evolving market; promoting competition and innovation; and stimulating billions of pounds of investments to ensure projects happen.

Since the OFTO regime was launched in 2009 the tender process has evolved significantly, to Ofgem's credit, creating increasing consumer value. There have been 12 OFTO assets awarded to three bidders thus far and over £1.4bn of debt and equity funds invested. There is potential for more than £10bn of further OFTO investment through 2020. Estimates indicate that the OFTO regime has created £300m of consumer savings while supporting the viability of offshore wind and enabling the UK government to meet legally binding 2020 renewables target.

Over the past five years, the participants in the OFTO market – our two main competitors and ourselves – have had to constantly refine our offering from a technical and financial

perspective in order to remain competitive. In 2013 we successfully closed the Greater Gabbard project utilising bond financing, the first OFTO project to do so. To date, Balfour Beatty has been awarded preferred bidder status on three OFTO projects by Ofgem, which cement our investor position in this market.

We attribute these wins to the contribution of both our people and our partners.

Our people are continually exploring new ways to maintain our competitiveness, drawing upon the broad skills of Balfour Beatty Group. With our main partner Equitix, we have huge experience as investors and developers of large infrastructure projects.

We're delighted to be a part of the offshore transmission regime, bringing renewable energy to the people of Britain and changing the blueprint of the UK's national power supply once again.

George Balfour would be proud... ■

Experts in Weather, Climate, and Risk.

With nearly 80 years of experience measuring, modeling, and interpreting weather, we support profitable energy decisions with advanced wind power forecasting and analysis.

Let's talk. Contact us today at info@3tier.com to learn more.

www.3tier.com



VAISALA

THE MISSING LINKS



Angela Merkel by medienmagazin pro via Flickr

Consumers in Germany are footing the bill for transmission link delays and now the government, led by Angela Merkel, is taking action

It is unlikely anyone would make a film about German offshore transmission. But, if someone did, they could call it *Transmission: Impossible*. Transmission has been a problem in this market for the last three years.

This month, the German government announced reforms to subsidies paid to renewable energy producers as it overhauls its Renewable Energy Sources Act.

Its aim is to cut the costs to consumers of subsidies that have exceeded €100bn since 2000. This includes costs of more than €1bn because offshore wind farms have not been linked to the grid in time.

Problems with offshore transmission have been a high-profile example of the rising cost of renewables. Yet the industry says changing the subsidies risk making it uneconomical for developers to build offshore wind schemes.

The government has also announced a target of 8GW of installed capacity in German waters by 2020. This is down from the previous target of 10GW but is not as harsh as the 6.5GW cap that the offshore industry had expected.

Merkel's government is due to finalise the reforms in August. While the 8GW cap is better for the wind industry than a 6.5GW cap, it still slows progress on Germany's clean energy transition.

This is an extra headache for a German offshore sector already tackling the financial and technical problems of installing transmission links.

Germany's offshore sector is working its way through the financial and technical issues of installing transmission links to offshore wind farms.

The German approach to developing offshore transmission networks differs markedly from the UK Offshore Transmission Owner (OFTO) regime. In the UK, the developer is responsible for building the transmission links and then ownership transfers to the OFTO investor. In Germany, the existing grid operators build these links.

State-owned Dutch firm TenneT does so in the North Sea; and 50Hertz, part of the Belgian grid operator Elia Group,

does so in the Baltic Sea. The North Sea is the bigger headache as more wind farms are planned there.

TenneT took on a group of offshore transmission projects in 2010 when it completed its acquisition of E.ON subsidiary Transpower, which owns an extra-high voltage transmission network in Germany. TenneT is now responsible for developing 13 offshore transmission links with total capacity of 8GW; but has experienced well-publicised financial and technical challenges with delivering these schemes. The knock-on effect of this has been delays in being able to connect offshore wind farms to the grid.

This is a good lesson for investors about the realities of the offshore transmission sector; and a good case study for nations who want to avoid the same issues.

Fixing the funding shortfall

The first challenge is money. The offshore wind sector has grown fast in Germany, particularly in the North Sea area that TenneT is responsible for. TenneT has not had the financial firepower to fund the development of these transmission



Source: Philippe Amiot via Flickr

Legislators at the Reichstag are due to implement changes to renewable energy subsidies by August

links on its own while maintaining its targeted A-/A3 credit rating from Standard & Poors and Moody's respectively.

This financial shortfall has opened up German offshore transmission to institutional investors. The company started to engage with infrastructure funds, pension funds and insurance companies at the start of 2011, with the aim of selling stakes in some of its offshore wind connection systems.

In January 2013, the firm entered a partnership with Mitsubishi Corporation, which invested €576m for 49% stakes in the high-voltage cable projects BorWin1, BorWin2, DolWin2 and HelWin2. The projects are set to have a total capacity of 2.8GW and require overall investment of €2.9bn.

TenneT followed this deal in February 2014 as it revealed a tie-up with Danish fund management company Copenhagen Infrastructure Partners, which is investing €384m in the 900MW DolWin3 offshore grid connection. CIP gained a 67% stake in the project and a 49% voting interest. The investor is part of Danish fund PensionDanmark.

TenneT confirmed in its 2013 annual report, published last month, that it is looking to agree similar deals.

Its report says: "In 2013, we expanded our cooperation with Mitsubishi Corporation as a financial investor for two additional German offshore projects. We continue to look at this type of equity financing for future projects. There seems to be ample interest and we are actively engaging with potential financial investors for specific projects that will start in the coming years."

These deals would be attractive for investors. The Federal Network Agency is guaranteeing a 9% return, and barriers to entry are low because TenneT doesn't need investors with expertise. This is just as well because few investors have the expertise needed.

Learning as they go

The second significant challenge for companies in the German offshore market is that they are developing projects with few precedents.

TenneT doesn't need investors with expertise, which is just as well given that few investors have expertise in this sector.

German offshore substations are far larger than those in other European countries. In the UK, offshore substations typically weigh 1,500-2,000 tonnes, whereas Germany's are typically 15,000 tonnes. The reason is that the UK favours point-to-point links where each wind farm has its own link to the grid, as do Belgium, Denmark and the Netherlands. Germany clusters its offshore projects so a few link to one substation, which means the links have to be much larger.

The upshot is that manufacturers end up producing parts on a scale they haven't done before. If there are delays here then it delays the development and installation of the substation, and delays the connection of wind farms to the energy grid — with costs incurred at each stage.

Siemens is among the companies that have experienced problems. In its 2013 annual report, the company says the power transmission division of its en-

ergy sector had incurred losses of €570m in 2012 and €171m in 2013 because of delays delivering offshore connections.

The company says these delays were "due to project delays resulting from a complex regulatory environment and the projects' complex marine environment, which required revised estimates of resources and personnel".

The size of these substations also raises a technical issue. They rely on HVDC (high-voltage direct current) transmission because HVDC is more reliable than AC (alternating current) over longer distances; and when larger amounts of power need to be transmitted. This technology is well-established onshore, but German offshore transmission is its first large-scale use offshore.

Kevin Todd, senior project manager for cabling at renewables projects services provider RES Offshore, says this adds to the cost of schemes. This is because DC converter stations are required at both ends of the cable: one to convert the AC to DC to allow for low loss transmission; and then to convert DC back to AC to get the power into the local grid. In addition there are usually two DC cables to be laid.

Todd says: "There is a question of when does DC becomes economical. As a rule of thumb, at about 80km to 100km it's time to seriously look at an HVDC submarine system."

This should not be a big technical issue, but it does add extra complexity to the networks being developed.

Building one of these transmission links is difficult. It is even more difficult to build a series of link with different tech-

nical requirements in different parts of the North Sea at the same time. This is the situation for TenneT and its suppliers, so it is little wonder that problems have arisen.

The sector has learnt that it takes five years to go from commissioning one of these projects to having it up-and-running, which is double the original estimate of two-and-a-half years. The industry is slowly working its way through these technical issues.

Globally, these teething pains are not necessarily a bad thing. They equip installers, developers, manufacturers and consultants with knowledge they can sell to other countries.

Peter Steinfeld, managing director at offshore project manager K2 Management and based in its Hamburg office, says it is significant that the country's offshore industry is still relatively new.

"We don't have a traditional offshore industry as in the UK, Denmark or the Netherlands. This kind of industry does

not yet exist in Germany, and we aren't always clever enough to look for outside help to avoid repeating mistakes," he said. Steinfeld added that companies in this market needed to look at international best practice.

Coping with the fallout

These financial and technical issues have resulted in delays connecting offshore wind farms to the grid, with the financial impact that has on developers.

The government moved to quell complaints from developers in 2012 when it announced new rules that says consumers would pay for 90% of the developers' losses through their energy bills. These rules came into force last year.

Rob Grimmond, chief executive of offshore cabling specialist Offshore Marine Management, says this would not be enough to fix the troubled system.

He says: "There is going to be a lot of clean-up work with, in some cases, litigation between the wind farm owners and TenneT over the loss of production, so that's going to go on for a number of

years. They are getting there with a better understanding of the systems... but it's going to have to be something that they work on to get to the next stage, which is 2015 onwards."

The situation has also become political. The German government is looking to cut the subsidies paid to the renewable energy sector, and this will have a knock-on effect on offshore wind. The fact that consumers are footing the bill for high-profile delays with offshore transmission links has clearly not helped.

For the global offshore sector, Germany's transmission teething pains are not necessarily a bad thing. They equip installers, developers, manufacturers and consultants with knowledge they can sell to other countries, and give investors an idea of the risks of investing in this emerging sector.

But the downside is that these long-running transmission problems may make other countries think offshore wind is more trouble than it's worth.

If both of those situations arise then all this pain would count for nought. ■

marine management
offshore

TRY AS YOU MAY YOU CAN'T PREDICT THE FUTURE

Offshore Marine Management delivers front end risk management and long term operations and maintenance services to safeguard investors' and developers' offshore assets in the renewable energy and offshore transmission markets.

Get in touch

+44 (0) 844 921 0001
info@offshoremm.com

www.offshoremm.com





Charles Yates, associate director in energy, cleantech and sustainability at Grant Thornton

BONDS: THE FUTURE OF OFTO FUNDING

Bonds are commonly used to fund deals for familiar infrastructure assets with reliable cash flow — and now in offshore transmission too.

The fit between the investment requirements of institutional capital for bonds and the steady cash flows generated by operational Offshore Transmission Owners (OFTOs) means that bonds are set to provide a large part of future OFTO funding.

The success of the first OFTO bond represents a good start for this asset class. In November, £305m of project bonds were issued to fund the purchase of the operational offshore transmission link for the 504MW Greater Gabbard wind farm.

In total, investors bid for around £900m of the bonds, and since the issue the yield has fallen from 1.25% over the benchmark government bond (a total interest rate of 4.137%) to 1.08% on 28 January. These amortising bonds mature in 2032.

This is also the first UK infrastructure project to use the European Investment Bank's (EIB) Project Bond Credit Enhancement (PBCE) initiative. The EIB has provided a £45.8m guarantee that resulted a one notch upgrade, to A3, in the bond's rating by the credit rating agency Moody's.

Under the PBCE model, additional liquidity will be provided if required, to allow enhanced recovery for senior lenders by acting as a first-loss piece and reducing outstanding debt.

Greater Gabbard shows that OFTO bonds meet the requirements of institutional investors, who are attracted to secure, long-term cash flows that match their liabilities and also give a 'yield pick-up' on the low returns available from government bonds.

Project bonds are becoming increasingly attractive as vehicles for infrastructure investment, and are an alternative to traditional project finance. For a large enough financing, the pricing and tenor benefits can be maxim-

ised by issuing bonds in the public market, which gives access to a wide pool of investors.

However, rating requirements and regulation mean the costs of publicly-traded issuance may be high and, as the interest rate is determined in the market, it is only known at the time of the financing.

In conclusion, OFTO bonds provide access to a new source of capital to finance the OFTO pipeline and provide cost effective interest rates and long tenors. We also expect to see bonds used to refinance operational wind farms to reduce the cost of debt and increase shareholder returns.

This approach plays to the ability of banks to manage construction risk and of bond investors to provide long-term, efficient debt once successful operations have started.

It also allows utilities to recycle capital from operational projects to fund the development of new projects. ■

DNV classed multi-purpose aluminium windfarm support vessels available for charter.

To discuss your requirements please do not hesitate to contact us.

T. +44 (0)1983 475315
E. info@seacatservices.co.uk
www.seacatservices.co.uk





World War II bombs by Mediagram via Shutterstock

DANGER: UXO

Problems with unexploded munitions at Riffgat and Gwynt y Mor have highlighted the risks that this threat can pose to transmission schemes

Next month, energy company EWE and developer Enova expect to start regular operation at their 108MW Riffgat project off the coast of Germany in the North Sea. They have had a long wait.

The developers completed 30 turbines at the project last summer, but could not connect them to the grid until February 2014 because of delays to the construction of the transmission network. Dutch transmission developer TenneT says delays to the installation of the export cable were caused by an unexpectedly large amount of unexploded munitions - over 30 tonnes - on the route.

TenneT says it has run up extra costs of more than €100m (£84m) because of the munitions, of which €57m (£48m) went on clearance and €43m (£36m) was the impact of the delays.

This is an extreme example of the costs that unexploded munitions - also known as “unexploded ordnance” or UXO for short - can add to the wind farms and transmission developments. These financial risks include the cost of delays; contractual disputes between project partners if one says the other has not taken

the UXO risk seriously; and the financial impact if a worker is killed.

The fallout from the Riffgat delays shows little sign of dying down.

Hundreds of thousands of tonnes of munitions have been dumped at sea, but nobody can be sure of the exact amount due to the secrecy surrounding this.

TenneT and EWE are now in dispute about who is liable for this extra cost. TenneT claims that the developers were responsible for setting the route of the cable, and it had been led to believe that unexploded munitions would not be an issue on this route. EWE has stated that the claims by TenneT are “demonstrably false and somewhat embarrassing”.

This is a high-profile example of the risks that marine UXO can present to wind farm and transmission schemes, but it is not an isolated incident.

In February, RWE Innogy had to halt construction in a 250m exclusion zone at its 576MW 160-turbine Gwynt y Mor project in Liverpool Bay when it found

three unexploded World War II bombs. The project is eight miles off the coast of north Wales and is due to complete later this year. The three bombs were disposed of last month; and the cost of this delay has not been disclosed.

Century in the making

Riffgat and Gwynt y Mor both show that UXO poses a risk to development timetables, and thus to business plans of investors. In Europe, it is a problem that has been a century in the making.

Countries in Europe including the UK, France, Germany and the Netherlands have dumped out-of-date munitions at sea since the end of World War I. This only ended in the UK in the late 1980s.

Experts estimate that hundreds of thousands of tonnes of munitions have been dumped at sea, but nobody can be completely sure given the secrecy surrounding this dumping. In German waters, the situation is complicated further by the dumping of chemical bombs and mustard gas agents.

Other unexploded munitions include aircraft bombs, sea mines and torpedoes.

All of these pose a threat for companies and individuals who are working on the sea floor. The most common danger is of projects being delayed at significant cost, as happened at Riffgat.

One of the major expenses is vessels. For example, there can be up to 50 vessels working on one of these projects, including crew transfer vessels, cable-laying vessels, anchor handling tugs, and jack-up vessel. The most expensive of these - a large jack-up vessel - can cost £200,000 a day to rent. That is potentially a lot of vessels doing nothing and costing a large amount in the process.

Unexpectedly coming across unexploded bombs can cause companies delays and cost millions.

Worker safety

Simon Cooke, managing director at 6Alpha Associates, which helps firms identify risks and dispose of them, says many firms do not have a realistic appreciation of the dangers; and that this is not just a risk for the business. Individual directors are at risk if the worst happens and someone dies.

Cooke says that the risks for UK firms associated with unexploded munitions have increased because of two pieces of legislation introduced in 2007: the Construction Design & Management Regulations and the Corporate Manslaughter & Homicide Act.

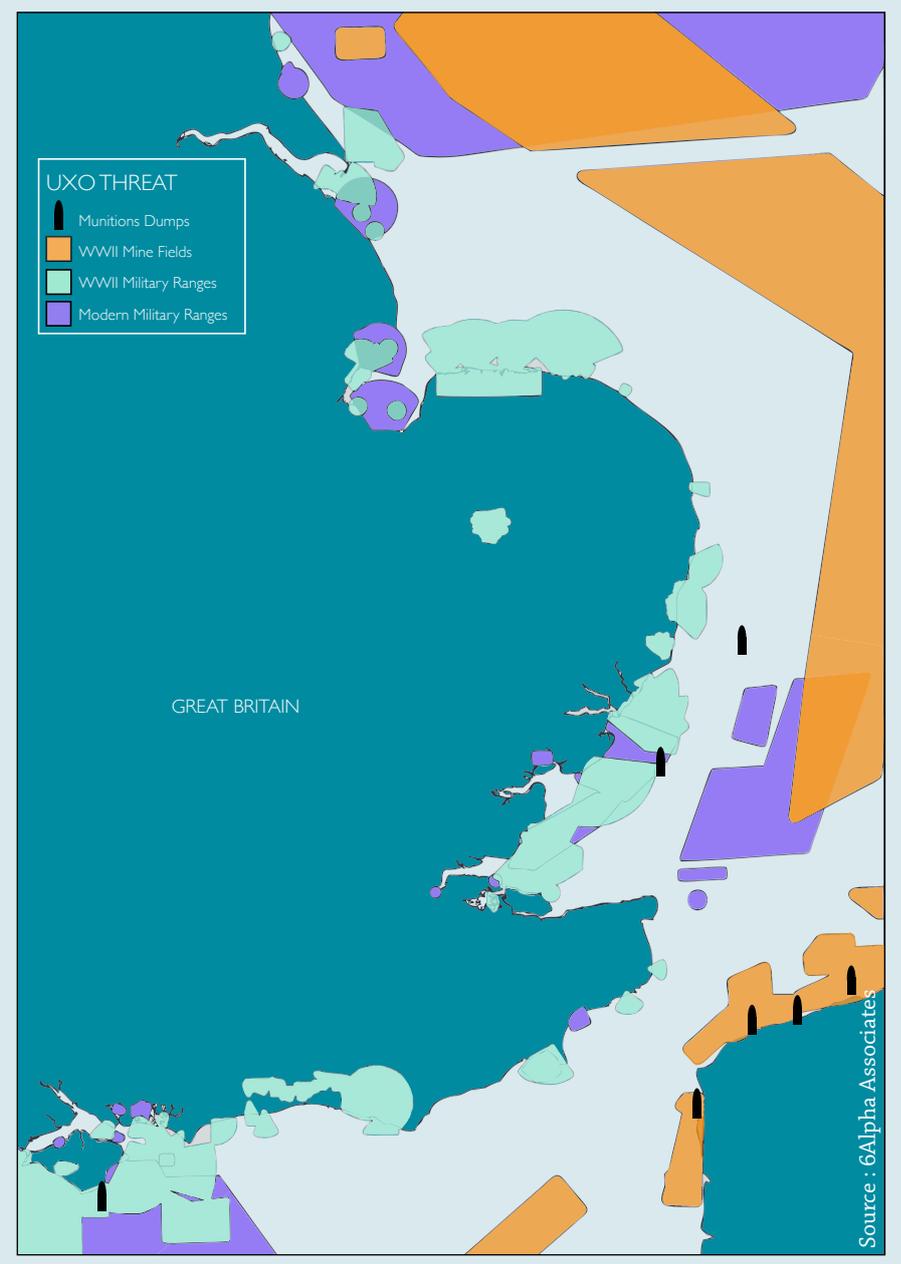
The effect of these is that UXO risks have to be addressed and managed in line with industry best practice. He says: "If there is a known risk to workers' safety and that risk is ignored, and there has been negligence, and a worker dies as a result then employers can be fined unlimited amounts of money and directors of companies can be put in the dock and put in prison if found negligent."

Cooke adds that the UXO threat is a known issue in European waters and says the wind industry as a whole is improving, but not all developers are paying the issue as much attention as they should.

The chance of a worker being killed may be low, but the consequences are severe if the worst does happen.

The other big risk for a developer is if a contractor does not think a development risk has been well dealt with on a site.

UXO Hotspot: North Sea and English Channel



This gives the contractor the opportunity to demand more money.

"They use it as an excuse," he says. "They end up facing each other across the boardroom table saying, 'Well, you haven't done this. You haven't done that.' UXO

"If best practice has not been applied and adhered to then the developer may be vulnerable to an ambush by a principal contractor."

is often played as a card, often unfairly, so if the best UXO risk mitigation practice has not been applied and adhered to then the developer may be vulnerable to an ambush by a principal contractor."

Dealing with the UXO threat early and professionally can help to address the

three main risks - unexpected project delays, worker death, and contractual disputes - that represent a financial threat to developers and investors.

Yet there are reasons to be positive. Developers such as Dong Energy, E.On and Masdar have taken a proactive approach to managing the risks at the 630MW London Array in the Thames Estuary; and so has Scottish & Southern Energy subsidiary SSE Renewables at its Beatrice Wind Farm in the Moray Firth off the east coast of Scotland, which is expected to have 920MW operational by 2017.

The global issue

Examples such as these should help to influence best practice in emerging markets where UXO is also likely to be a problem, such as North America and the

Asian part of the Pacific Rim. There are countries in these parts of the world with offshore wind ambitions and where UXO could be a threat.

For example, following World War II the US government designated disposal areas for UXO off the Atlantic and Pacific coasts, and in the Gulf of Mexico.

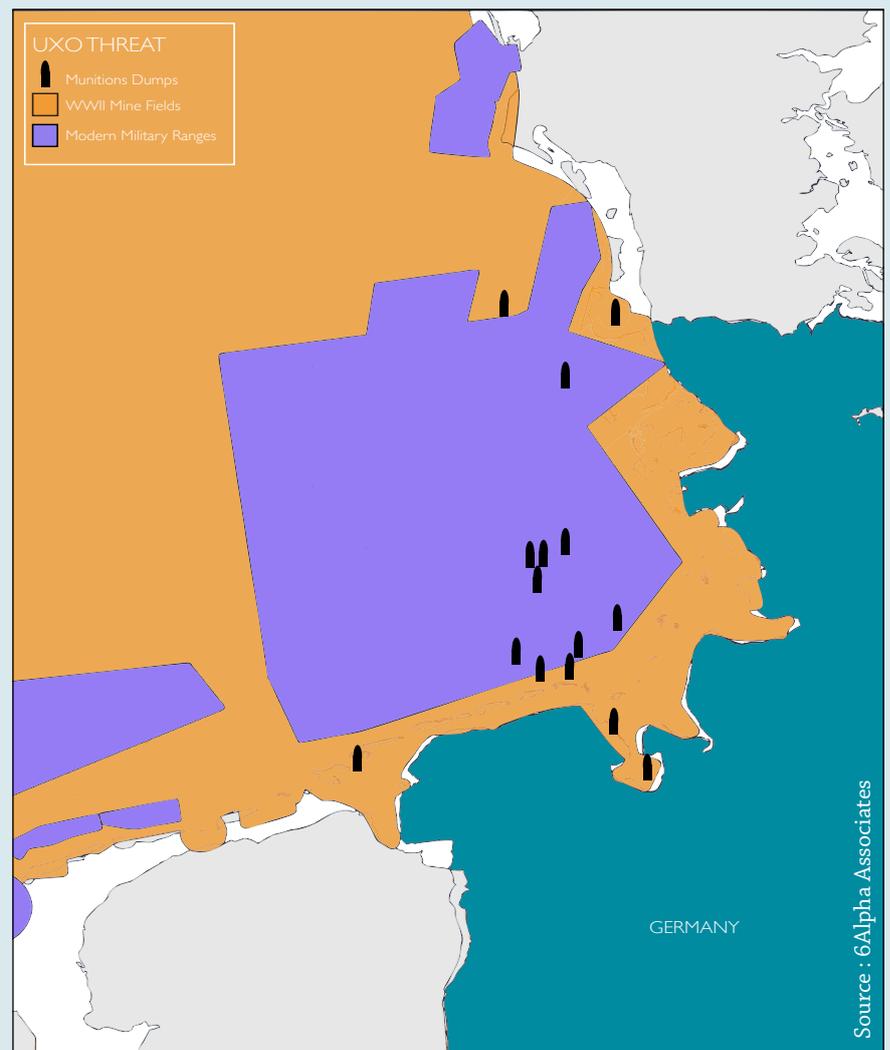
Millions of pounds of bombs and chemical agents were disposed in these areas until the US banned marine UXO disposal in 1972. Nobody knows what was disposed of, in what quantities, and what risk it presents.

There is also a risk that some of these US munitions have been “short-dumped” before they reached the dedicated disposal site.

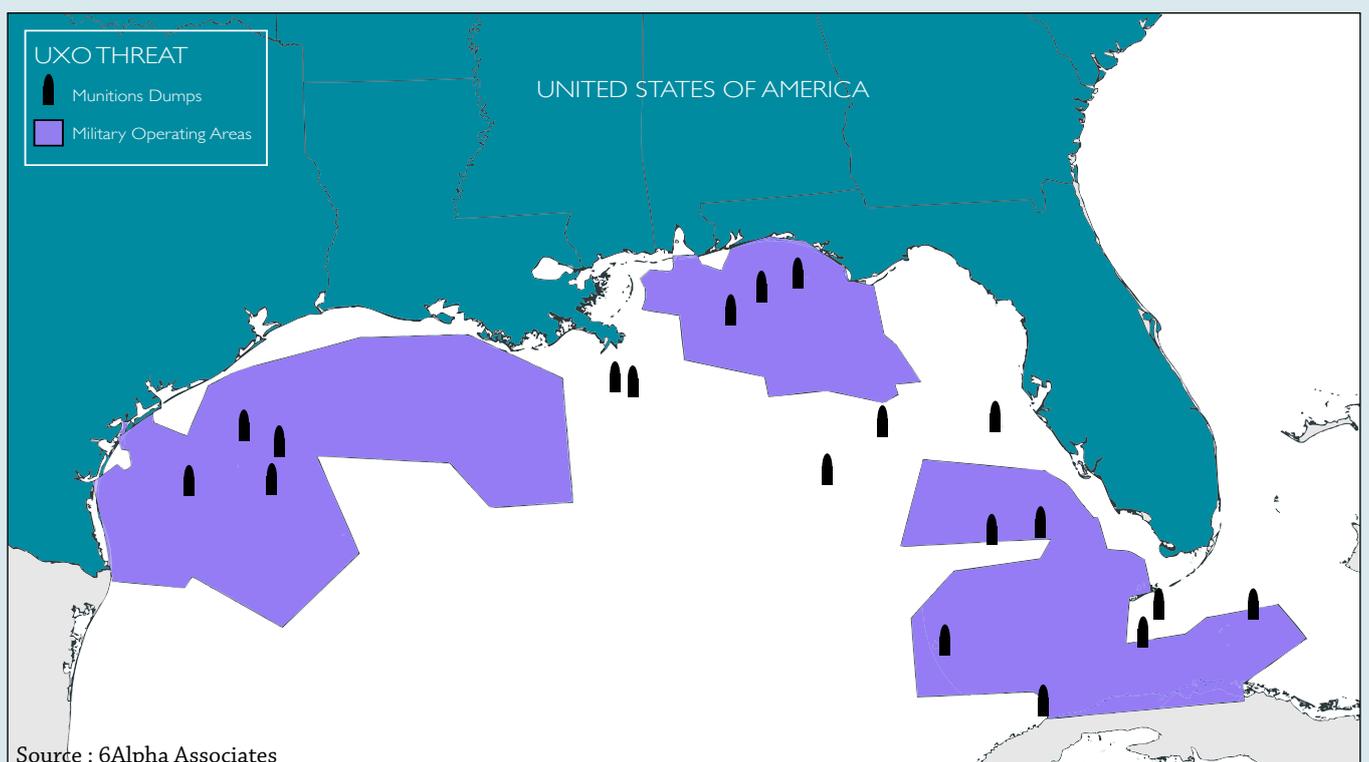
There is also a risk that some of these US munitions have been “short-dumped”, which means the vessels transporting the munitions disposed of them before they reached the designated disposal site. This would leave the munitions far closer to the shore than they should be.

Offshore wind farms are set to become a feature in some of these areas. As they do, developers of transmission schemes would do well to remember Riffgat. ■

UXO Hotspot: German North Sea



UXO Hotspot: Gulf of Mexico





Barry Howarth is director and senior consultant at Subsea & Offshore Solutions Ltd.

LET'S FIX THE INDUSTRY'S ATTITUDE TO REPAIRS

The UK wind sector is growing up and needs to take repairs more seriously. More firms need to be proactive about repair risk management.

The total capacity of UK offshore wind farms is 3.6GW, and the government says this could grow to 18GW by 2020. DECC also wants to cut the operational cost of offshore wind by over 25%, from £135/MWh to less than £100/MWh. Repairs will be key if we want to achieve this because a major part of the overall operational cost is the expense of subsea cable repairs.

There are 1,075 turbines in UK waters, with 530,000 metres of medium voltage inter-turbine cables and 880,000 metres of export cables. That's a lot to go wrong.

The cost of cable failure is high. Repairs at sea typically cost ten times more than an equivalent repair on land; can take several months rather than a few days; and there is also the cost of lost generation.

To date, the UK offshore wind industry has suffered a higher-than-expected number of medium and high voltage cable faults. Such faults make up more than 80% of the offshore wind farm insurance claims, with poor workmanship and poor testing frequently cited as contributing factors. We can address this through better repair preparedness and a more proactive repair risk management strategy.

There appears to be a lack of knowledge and experience in many key elements associated with the management of subsea cable repair. Owners and operators appear to have little understanding of cable fault location methods, and how to work with the many stakeholders affected. This increases the time and cost of repairs.

Those problems are compounded by the OFTO regime, which puts export cables in the hands of third parties that have financial and commercial drivers that make preventative maintenance a low priority.

Fixing the problem is trickier, but we can learn from the oil & gas, offshore telecoms and electrical interconnectors sectors.

Good practices include repair strategies; and stand-by contracts with firms including vessel suppliers. The wind industry should also form a "cable spares club" like the telecoms industry's Atlantic Cable Maintenance Agreement (ACMA). Many of the vital spares, materials and equipment needed to complete repairs are hard to obtain and on long lead times. Pooling resources could help cut costs.

We also need a European power cable maintenance agreement or service that can provide the basis of a repair preparedness platform. This could either take the form of a club, like ACMA; or a holding company run by major wind industry players.

This isn't just about repairs. A more proactive approach to repair preparedness would help drive down the cost of offshore wind and make the industry more attractive. ■



MEET THE JUVICKS

China wind farm by Ismoon via Wikimedia Commons

Economic superpowers have offshore wind ambitions, but this won't necessarily result in opportunities to invest in transmission.

Working in the offshore sector in Europe? Getting itchy feet? That's understandable.

While Europe is the world's largest offshore wind market today, we can't expect this to always be the case. Economic superpowers in Asia are looking at how

to grow their offshore sector; and there are plans to grow offshore in parts of North America too.

These markets may differ from each other, but they would all need to find a way to connect offshore turbines into their grid. Here, we look at six countries that

we've christened the JUVICKS — Japan, United States, Vietnam, India, China, South Korea — that have plans to grow offshore wind by 2020.

What is the state of these markets? And will this present opportunities to invest in transmission?



China is the world's fifth largest offshore wind market and the largest outside Europe, with 416MW currently installed. This is less than 0.5% the size of its 91GW onshore wind market.

The country's two offshore wind farms are the 232MW Longyuan Rudong intertidal scheme in Ji-angsu province; and the 102MW Donghai Bridge project close to the Shanghai bridge it was named after. There are also several prototype projects and individual test turbines.

But China has also set itself the huge target of increasing its offshore sector to 5GW before the end of next year - which it is very likely to miss - and to 30GW by 2020. This 2020 target is more than four times the amount of offshore wind capacity currently installed worldwide. The target is unrealistic, but it does at least show that the country has ambition.

If China delivers the huge rise in offshore capacity it is targeting - or even if it gets anywhere close - then it will need a huge grid. But this is unlikely to lead to significant opportunities for companies to invest in Chinese transmission. Its offshore grid is developed and run by the same organisation that runs its onshore grid: the State Grid Corporation of China, set up in December 2002.

China's grid corporation supplies power to 80% of the country and is the seventh largest firm in the Fortune 500.

The two grid companies are the State Grid Corporation of China, which runs five of China's six regional power grids; and the China Southern Power Grid, which runs the sixth. The State Grid Corporation supplies power to more than 80% of China that is populated by more than 1 billion people. It is the largest electric power transmission and distribution company in the world; and the seventh largest company in the Fortune 500.

The corporation also has huge spending power. It is in the middle of a five-year investment plan to invest \$400bn in power grid construction by 2016, of which

\$100bn is in smart grid technology; and it has made grid investments in countries like Australia, Brazil, and Portugal.

For international investors, this means there is little opportunity to own offshore grid links. There is no political or economic need for China to sell off parts of its grid to international investors. So far, investment in offshore wind farms has been restricted to state-owned utilities and the China Development Bank.

But growth in the offshore wind sector in China will open up more opportunities for firms that develop turbine and transmission technology. This is an area where the Asian superpower has welcomed foreign firms, such as in the \$226m joint venture between Shanghai Electric and Siemens in 2011.

There should also be opportunities for UK firms following an agreement signed between the UK government and China's National Energy Administration to partner on offshore wind technology.

Bringing in partners that can help keep China at the forefront of wind innovation is one thing. Allowing foreign companies to buy a stake in the energy grid is quite another, and unlikely. ■



India is the world's fifth largest producer of wind power with over 20GW up-and-running at the end of 2013, according to the Global Wind Energy Council's statistics in February 2014.

The wind-rich region of Tamil Nadu is one of the main wind power hubs in South Asia with capacity of over 7.1GW, ahead of Gujarat (3.2GW), Maharashtra (3GW), and Rajasthan (2.7GW). But the take-up of wind power is patchy nationwide, and non-existent when you get offshore.

Offshore efforts so far have been limited to preliminary assessments. This was the verdict of a draft national offshore wind energy strategy document published by the Indian government's Ministry of New and Renewable Energy in May 2013. Even so, these assessments have started to gain the government's interest.

These reports show that there is significant potential for offshore wind off the provinces on India's western coast, from Gujarat and Maharashtra in the north to Goa, Karnataka and Kerala in the south. There is also significant potential off the eastern coast of Tamil Nadu.

The government is exploring this further, and in January 2014 it entered a partnership with the Global Wind Energy Council to carry out a four-year research programme to develop a roadmap for offshore wind development in the country, with a focus on Gujarat and Tamil Nadu.

GWEC is set to work closely with the Ministry of New & Renewable Energy, state governments, and other parts of the government to look at the challenges and opportunities of offshore wind.

The European Union has backed the project with a €4m contribution from its Indo-European Co-operation on Renewable Energy programme. The partners involved in the study include the World Institute for Sustainable Energy; The Center for Study of Science, Technology and Policy; and DNV-GL, the world's largest renewable energy consultancy.



Labourers working at a diesel-powered crusher in front of a wind turbine

One-third of India's grid electricity is lost to theft or inefficiencies, and a major blackout in 2012 left 600 million people without power.

Alok Srivastava, joint secretary at the ministry, said when the project launched that the study "falls perfectly in line with the vision of the government of India for development of offshore wind power in the country".

He added that the ministry is seeking to introduce a national offshore wind policy in India. And this policy aim may get another boost depending on the result of the Indian general election.

The election is now underway and voting is due to finish on 12 May, with votes to be counted on 16 May. One of the leading candidates is Narendra Modi, who led a wind energy revolution in Gujarat, where he has been chief minister since 2001. Modi has promised an "energy revolution" if he comes to power, and renewables would be a major part of that.

But it wouldn't be easy. The Ministry of New & Renewable Energy has already identified that it will be a challenge to develop a transmission network to link offshore projects into the grid.

It is little surprise the ministry is worried given the state of the onshore grid.

India operates five regional grids, and the state-owned company Power Grid Corporation of India manages around 50% of the total power generated in the country. However, over one third of India's grid electricity is lost to theft or inefficiencies; and a major blackout in 2012 left 600 million people without power.

This is not necessarily a bad situation for offshore businesses, though. If India opts to grow its offshore wind capacity then there are likely to be opportunities for companies, including investors, with expertise in transmission to show the government how to get it right.

Investors will get a better idea of the potential opportunities when the Central Energy Regulatory Commission and state electricity regulatory commissions finalise the offshore transmission rules, but this is still a long way off. Investing in offshore transmission in India won't be a quick win as the offshore study by GWEC and the Indian government is set to last four years, until 2017.

But the government is aware that offshore transmission is a concern. Once it identifies its exact problems then it will look for firms that can solve them. ■



Japan is one of the most exciting offshore wind markets outside Europe, even though it only has a tiny 49MW operational. So why so exciting?

The first reason is the fast pace of change. The Fukushima Daiichi nuclear disaster three years ago, which is one of the worst ever disasters of its kind, has soured the country's relationship with nuclear power. This has increased the appetite for renewable energy in some regions.

For example, the province of Fukushima wants to generate 100% of energy from renewable sources by 2040; and work has started on the test phase of a wind farm project off the coast of Fukushima that could grow to 143 turbines totalling 1GW by 2020. The scheme is being led by the Marubeni Corporation. This is going on despite the agenda of prime minister Shinzo Abe to restart nuclear power.

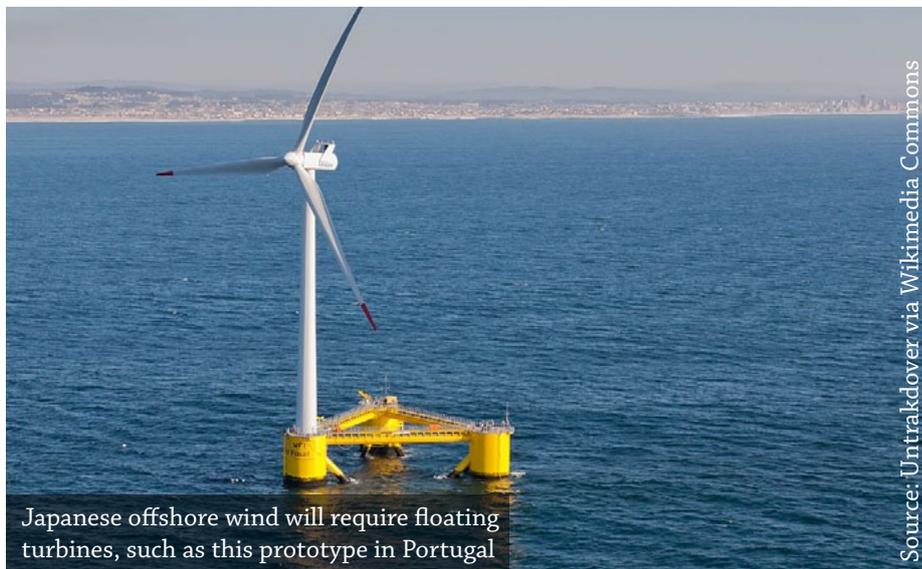
The second reason Japan is exciting is that it is driven by similar geographical concerns that have made the UK the world's offshore wind leader. It does not have vast tracts of land for onshore wind farms like China, India or the US; and so there is an incentive to look to its waters.

And the third reason is that the Japanese government has this month introduced



South Korea sits between China and Japan, and it is no surprise that it takes a similarly open-minded approach to wind power. It had 561MW of onshore capacity installed at the end of 2013, but is only dipping its toe in the water offshore, where it has just 5MW.

But that doesn't tell the full story. South Korea is aiming for 11% of power from renewable sources by 2030, and there are



Japanese offshore wind will require floating turbines, such as this prototype in Portugal

Source: Untrakover via Wikimedia Commons

Floating transmission networks will be needed to make projects work in deep Japanese waters.

incentives for offshore wind farms. It has brought in an offshore wind feed-in tariff of ¥36 (21p) per Kwh, an increase from the ¥22 (13p) currently available to both offshore and onshore schemes. Some analysts have questioned whether the rate is high enough to make a big difference, but it is at least positive to see offshore wind getting more support.

One of the biggest challenges in Japan is the fragmented onshore transmission infrastructure. Its grid network is in the hands of ten regional utilities companies, and the interconnections between these areas are lacking. It will be a challenge to link offshore projects into this network.

And, for transmission developers and investors, the other big issues are tech-

more than ten offshore projects planned in the country's coastal waters with a total capacity of just under 5GW. The largest of these, a 2.5GW project off the southwest coast in Jeolla province, is due to begin testing later this year. The country is planning to grow offshore.

The Korea Electric Power Corporation owns and runs the electricity grid, and there is no indication of that changing any time soon.

But transmission investors shouldn't get too excited. The Korea Electric Power Corporation is a state-run company responsible for more than 90% of the

nical. The network would have to be able to stand up to the seismic activity around Japan; and would need to be installed in waters much deeper than those in Europe. This increases risk for developers.

Deeper waters are leading the technological innovation among turbine developers. For example, the test phase of the Fukushima project involves the installation of three floating wind turbines — two developed by Mitsubishi Heavy Industries, one by Hitachi — and a floating power sub-station. Floating transmission networks will also be required to make these projects work.

Investing in these transmission networks would clearly be risky until that technology is established. However, Japanese companies have a long-held reputation for technical innovation; and the country is open to foreign investors.

It is a market worth watching closely. ■

country's electricity generation, and is behind projects including the 2.5GW scheme in Jeolla province. It also owns and runs the electricity grid, and there is no indication of that changing any time soon.

That isn't to say there won't be opportunities in for offshore wind companies. Last May, KEPCO established a joint venture with long-term partner Alstom Grid to improve the grid; and, last November, KEPCO signed a deal with Areva to work on renewable energy projects.

As KEPCO develops its offshore transmission networks there will be potential for companies that can bring innovative technology and thinking. Just don't expect to own part of the grid. ■



The US is second only to China in terms of total wind power production, with 61GW installed. But none of this is in offshore wind farms.

The lack of progress offshore is understandable given the amount of land available to build wind farms onshore. The US Department of Energy has estimated there is potential to build offshore wind developments totalling 900GW along its coasts and in the Great Lakes, but the

lower costs of building onshore suggests that offshore wind would only achieve, at best, a small fraction of that figure.

Even so, plans are afoot. In February, developer Cape Wind Associates announced that Danish export credit agency EKF has agreed to lend \$600m to help fund its planned 420MW Cape Wind project in Nantucket Sound; and last month it added to this with \$400m from Natixis and Rabobank. The scheme had previously attracted \$300m from The Bank of

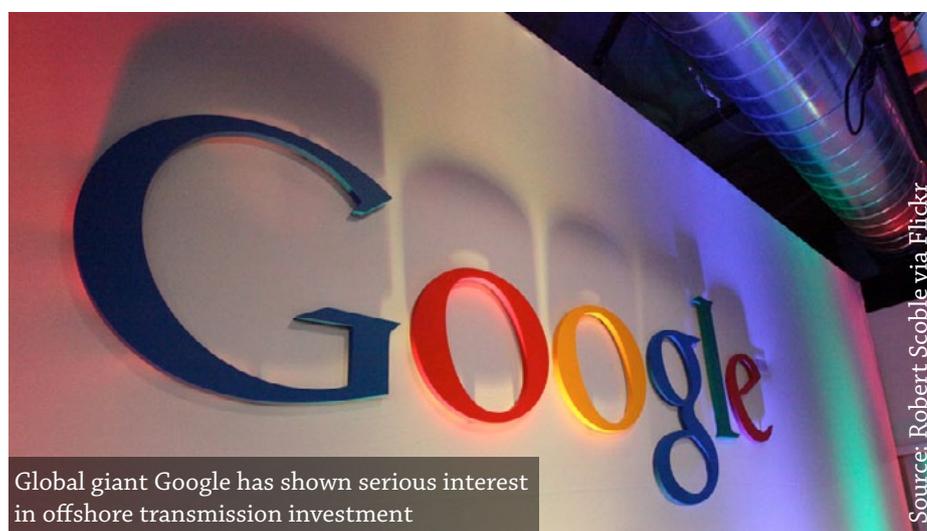
One difficulty for prospective investors would be accessing a market in competition with global firms like Google with such mighty financial firepower.

Tokyo Mitsubishi, PensionDanmark and Siemens. Cape Wind Associates plans to start construction of the onshore cable route this year, with ocean construction to start in 2015 and complete in 2016.

There are other developers vying to get the first offshore wind project running. Deepwater Wind plans to start work this year on its \$250m 30MW Block Island project off the coast of Rhode Island so it can complete in 2016. National Grid US last month agreed to take over responsibility to build the 21-mile transmission cable to connect the project to land.

Global companies have also started to invest in offshore transmission links. The Google-backed Atlantic Grid Development is planning to start work on a \$1.8bn link off the US east coast, the New Jersey Power Link, as early as 2016. This is intended to be the first phase of the \$5bn Atlantic Grid Connection, which is a proposed transmission backbone stretching from New Jersey to Virginia.

The issue for investors considering investing in US transmission isn't whether the country would welcome overseas investment. It would. But it would be tough to access the market in competition with firms with such mighty financial firepower. Another difficulty is whether enough wind farms would be built offshore to make that effort worthwhile. Both must be major doubts. ■



Global giant Google has shown serious interest in offshore transmission investment

Source: Robert Scoble via Flickr



With a coastline of 3,260km along the South China Sea and a total land mass smaller than Japan, it is understandable that Vietnam is looking at developing offshore wind.

It is currently the second largest offshore wind market outside Europe, with 99MW installed. That 99MW figure is slightly misleading, though. It only refers to one project - the first phase of the Bac Lieu wind farm - and it is debatable whether that is an offshore project at all. It is called offshore because it is in part of the Mekong Delta that is prone to seasonal flooding.

Bac Lieu is one of a handful of working wind farms in Vietnam. Despite this, the country has an ambition to install 1GW of wind power by 2020, and growing this to 6.2GW by 2030.

The country is no stranger to quick change in the energy market. Only 2% of households were electrified in 1975, and this is now more than 96%.

But will it get anywhere close to this?

One reason to be positive is that the country is no stranger to quick changes in the energy market. Only 2.5% of households were electrified in 1975, and this is now in more than 96%.

The Vietnamese government also has a target of growing its total installed power capacity to 75GW by 2020, which is an ambitious aim given that installed capacity in 2010 was just less than 22GW.

Hand-in-hand with this growth, the country has spent the last three years reforming the way the electricity grid is owned and operated. In 2011, the government introduced power reforms that included a stipulation that power generation and transmission must stay in the control of state-run Vietnam Electricity.

But this does not mean that the country is closed to foreign companies.

In December, for example, General Electric signed a contract with the Electricity Regulatory Authority of Vietnam to develop a new transmission grid code. This will enable the integration of up to 6GW of new wind power into the country's electricity grid. The country also needs billions of pounds of investment to upgrade its transmission network, which is already under pressure.

There will be opportunities for the brave, and transmission specialists will find more of these onshore than offshore. ■

Quarterly Drinks

Don't miss our Quarterly Drinks - informal, focused networking evenings, exclusively for our members

19th June, 4th September & 6th November.

Places are strictly limited, email membership@awordaboutwind.com to reserve your place!

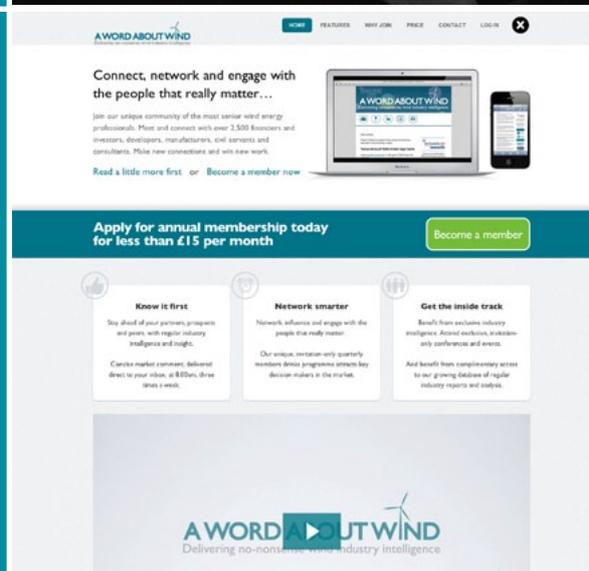


New membership platform

As part of a wider programme of investment, in summer 2014 we'll be launching an entirely new digital platform from which our growing membership base will benefit.

The website and platform will include future information on our programme of conferences, events and reports, as well as providing access to our growing archive of industry intelligence and insight.

Ahead of the launch, we will be inviting a closed group of carefully selected members for their input and views. To request to take part in this and to have your say, email adam@awordaboutwind.com.



Our next report

Hidden Investment Opportunities - where should you invest in the next two years? We investigate the emerging markets, sectors and financial structures that you haven't previously considered, and assess the benefits and the risks.

Hidden Investment Opportunities will be published on 9th July 2014. For advertising information and to find out further information, email advertising@awordaboutwind.com.



HIDDEN INVESTMENT OPPORTUNITIES

An investigation into emerging markets, sectors and financial structures.

A WORD ABOUT WIND

