Initiative for Global Leadership in Offshore Wind

The European wind energy industry welcomes the ambition and support from the European Commission towards offshore wind energy. In particular, we share the view that the European industry in offshore wind needs to maintain its competitive position in the global markets. With the vast majority of expertise in developing and financing offshore wind, as well as manufacturing excellence based in Europe, the opportunity to maintain a first mover advantage will serve to access emerging markets for this technology globally.

To this end, offshore wind energy needs to reduce its cost of energy and become fully competitive against conventional generation. The industry itself has recognized this need and key players have set themselves cost reduction targets already to 2020[1]. Delivering these targets will depend on both, a united industry and on continued support from policy makers, not only by maintaining research and innovation funding, but above all, by providing the visibility of the necessary volumes of projects to fully realise potential improvements and innovations.

Therefore the European wind industry calls for the European Commission and Member States to define cost reduction targets post 2020 in tandem with a clearly committed volume of deployed projects. These indicative levels of ambition for offshore wind energy could then be taken up in the individual Member States' renewable energy pledges to meet the 2030 EU binding renewable energy target. In addition to making up part of a Member State renewable energy pledge, as a shared marine resource, offshore wind could be utilized as a regional cooperation mechanism to close the gap should Member State pledges be insufficient to meet the 27% target.

As noted in the issues paper that this letter responds to, countries outside Europe have set not only cost reduction targets, but also deployment levels of offshore wind: *"The United States strives for 10 GW of offshore wind deployment in 2020 at a cost of 90/MWh and 54 GW in 2030 at 65/MWh."*. On the other hand, currently there are only four Member States with post-2020 renewable energy policies in place and only one with a wind energy specific target[2].

The European Wind Energy Association expects offshore wind power to grow to 23.5GW by 2020, and to 66.5GW by 2030[3]. In tandem with a target for deploying offshore wind to these levels, the industry recognizes that there is good potential to continue delivering ambitious cost reduction targets to 2030 to a level of 7€ct/kWh, though research on assessing the ambition level of this target is required. Failing to deliver this minimum volume of projects, risks committing to cost targets that only a very limited number of players and Member States could deliver, with the unintended consequences of market concentration and competitiveness that this could bring about.

Finally, the wind energy industry endorses the relevant actions included in the annex of the issues paper, which form part of the previously consensually agreed document "Towards an Integrated Roadmap" of the SET Plan. The proposed targeted R&I actions for the *advanced research programme, the industrial research programme and the innovative and market-uptake programme*, are in our view appropriate to address the "*issues*" defined under the "*Challenge 1: wind energy*".

Today

As a young and emerging industry, offshore wind has grown as policy makers and industry have sought to capture the vast resource available at sea. As of 30 June 2015, cumulatively, there are 3,072 offshore wind

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[1] DONG Energy (2013) Offshore Wind Cost of Energy
Recharge (2014) Vattenfall eyes 40% offshore cost-out
Siemens (2013) Wind power on its way to cost reduction
[2] France has a target 35% of renewables by 2030, The Netherlands 16% by 2023, Sweden and Denmark have a 100% renewable target by 2050. Denmark has a 50% target for wind energy by 2020
[3] EWEA, 2015. Wind energy scenarios to 2020 and 2030

turbines with a combined capacity of 10,393.6 MW fully grid connected in European waters in 82 wind farms across 11 countries, including demonstration sites.

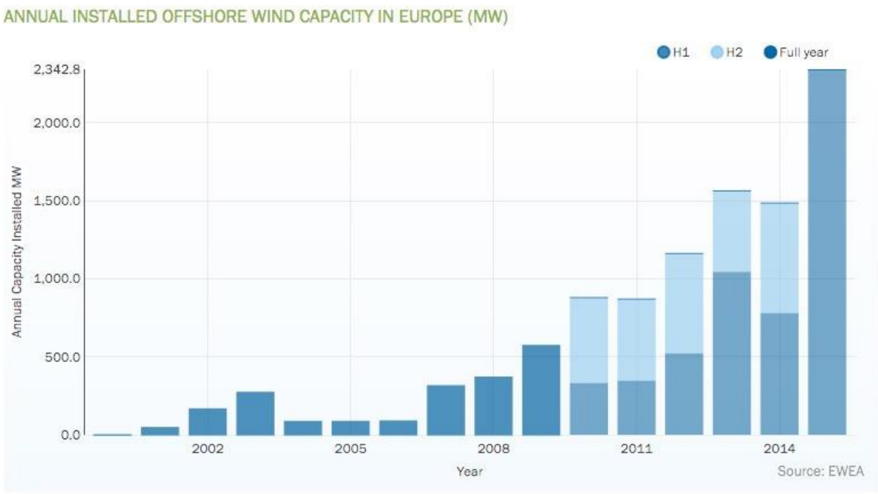
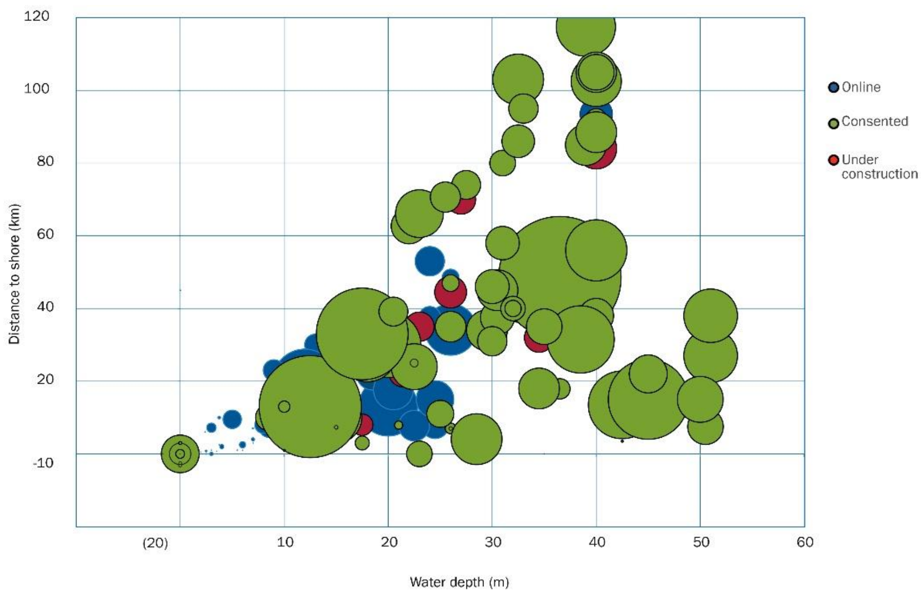


Figure 1: Annual installed offshore wind capacity 2014 – H1 2015[4].

Offshore wind has gathered momentum since the turn of the century, and has experienced gigawatt levels of growth since 2012, with a 5 year compound annual growth rate of 31%. With over 90% of global installations located in Europe, there is a real opportunity for European industry to fully mobilise its industrial base and experience and cement its global position in the future.

Delivering on cost reduction will ensure that the industry is able to continue beyond 2020 and further its contribution to providing significant volumes of clean, fuel-free electricity. The installation of larger capacity turbines has helped to not only produce more electricity, but to generate better project economics. Compared with H1 2014, average turbine sizes increased to 4.2MW in H1 2015 from 3.7MW, representing a 20% increase. Alongside technological development, the better integration of the supply chain and optimisation of logistics will yield further cost reduction. This is a necessary step as projects move further from shore and into deeper waters, requiring better planning and logistical coordination.



Source: EWEA

Figure 2: Average water depth and distance to shore of online, under construction and consented wind farms as of January 2015[5].

[4] EWEA (2015) The European offshore wind industry – key trends and statistics 1st half 2015
[5] EWEA (2015) The European offshore wind industry – key trends and statistics 2014

Offshore Wind Energy to 2020 and 2030

EWEA expects offshore wind energy to develop 23.5 GW to 2020 and 66.5 GW to 2030 in its Central Scenarios and as high as 27.8 GW to 2020 and 98.1 GW to 2030 in the High Scenario,

	Installed Capacity (MW)			
Country	Central 2020	High 2020	Central 2030	High 2030
Belgium	1,500	1,800	3,000	3,800
Denmark	2,800	3,000	3,530	5,320
Estonia			750	1,500
Finland	26	26	26	26
France	1,500	1,500	9,000	15,000
Germany	6,500	7,500	17,500	22,500
Greece				500
Ireland	25	200	800	1,200
Italy				500
Lithuania				1,000
Netherlands	1,400	2,000	6,500	7,000
Poland		500	1,350	2,200
Portugal	25	25	27	27
Spain	5	5	5	500
Sweden	212	212	1,000	2,000
UK	9,500	11,000	23,000	35,000
Total	23,493	27,768	66,488	98,073

Table 1: EWEA Scenarios for 2020 and 2030, Central and High scenarios

However, the industry faces uncertainty of specific projects in the post-2020 period. The figure below shows the projected potential reduction in annual installed capacity for 2020 through either delayed consenting or lack of commitment on post-2020 targets. **In order for cost reduction investments to fully realise a return, a minimum of 4-5GW of projects per year must be delivered.**

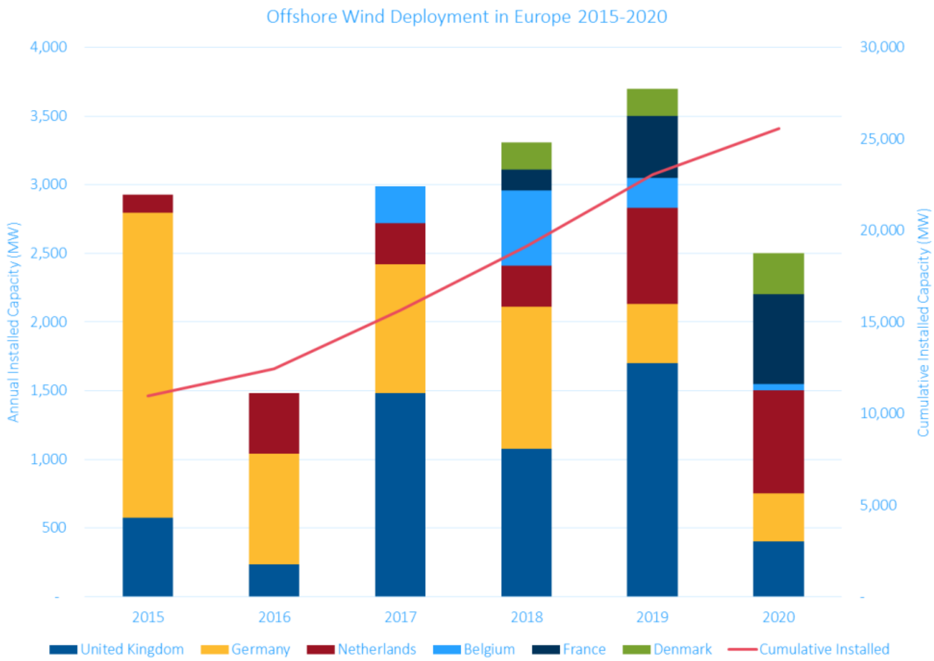


Figure 3: Projection from project data showing indicative deployment roadmap of offshore wind projects 2015-2020[6].

A visible and stable growth pathway set out by policy makers will allow the industry to fully realise improvements in cost reduction, as well as ensure future investments into the industry. In the UK, the largest offshore market to 2030, it is recognized that *"an average [European] deployment rate of 3GW to 4GW is the most important single driver of cost of energy reduction[7]".*

Cost Targets

Strong policy support via the backing of a clear pipeline of projects is a pre-requisite for cost reduction. It is of utmost importance for the industry that Member States set the vision of expected offshore wind energy levels post-2020 with accompanying cost reduction targets. This indicative level of ambition for offshore wind energy could then be taken up in the individual Member States' renewable energy pledges to meet the 2030 EU binding renewable energy target.

Industry recognises the immediate importance of delivering on cost reduction to safeguard and secure the sector in the long term, and some companies have set an ambitious target of EUR100/MWh by 2020. Industry backs continuing cost reduction beyond 2020 aiming towards achieving cost-competitiveness by 2030.

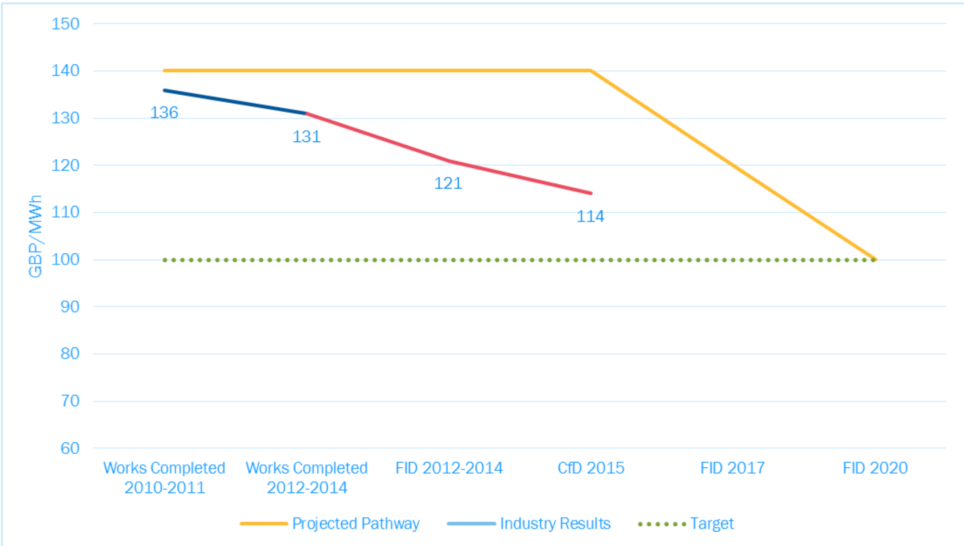


Figure 4: ORE Catapult Cost Reduction Monitoring Framework results, including CfD results in 2015 for Neart Na Gaoithe[8]

As offshore wind heads towards further industrialisation, costs are being reduced which demonstrates industry commitment to take the technology to cost-competitive levels. The UK ORE Catapult's Cost Reduction Monitoring Framework has shown that the Levelised Cost of Energy (LCOE) of offshore wind is being reduced ahead of its projected pathway towards a level of GBP100/MWh (€141/MWh)[9] for projects reaching Final Investment Decision (FID) in 2020[10].

Floating designs will also firstly need to achieve commercial deployment in order to make the cost reductions that economies of scale bring.

[6] EWEA Business Intelligence analysis
[7] BVG Associates (2015) Approaches to cost-reduction in offshore wind
[8] ORE Catapult (2015) Cost Reduction Monitoring Framework – Summary report to OWPB
DECC (2015) CFD Auction Allocation Round One
[9] FX rate: ECB EURGBP fixing 0.70705 as of 13 November 2015
[10] Crown Estate (2012) Offshore Wind Cost Reduction Pathways Study

It should be noted that the majority of existing targets and literature on cost reduction[11] (both studies and cost reduction results) make similar observations on cost reduction target but that very little of the literature provides an assessment for 2030.

Whilst the offshore wind industry fully supports its transition to becoming a cost-competitive source of energy, a level of 7€ct/kWh by 2030 needs to be fully scrutinized with deep analysis and research. Uncertainties related to determining a cost target level for 2030 relate to the pipeline of projects that can be built out over the coming years as well as the relatively long time horizon when faced with commodity and power price volatility. Furthermore, given the extent of market transformation under the Energy Union and the 2030 Framework for Climate and Energy, all variables need to be assessed fully in order to assess the risk of over/under-ambition in setting a cost target.

Reliability and Capacity Factor Targets

Increase the reliability of offshore wind to 99% and the Capacity Factor to 55% by 2020

As part of good business practice, site developers, owners, and suppliers will naturally gravitate towards adopting technology which maximises the wind yield and with high operational availability. **Hence, the industry believes that a capacity factor is already integrated into a cost target.** It is necessary to reach a level of reliability that is as high as possible, for both generation and transmission assets. The Crown Estate states that current offshore wind farms typically achieve availability of between 90-95%[12]

Capacity factor however, is predicated on inherent site characteristics. The industry supports the proposed activities to refine resource assessment and forecasting technique, but points out many factors which also affect this level.

Currently, site allocation in countries is performed centrally via national authorities or via marked out zones first, an initial restriction placed on developers, who must then maximize the site yield. In addition, planning restrictions on park layout such as line of sight requirements can also further impact wind yield. Developer control of capacity factor is therefore limited to the configuration of available technology which can also be locked in during the planning phase, and does not allow developers to take advantage of more up-to-date technology closer to the time of construction.

It is possible to utilize lower capacity turbines with low cut-in speeds which would drive up the capacity factor, but not necessarily maximize electricity production. However, in parallel with natural good business practice, a cost target to 2030 will push site owners and developers to maximize the wind yield of the available resource, and therefore maximize the production of electricity, irrespective of capacity factor.

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[11] DONG Energy (2013) Offshore Wind Cost of Energy
Recharge (2014) Vattenfall eyes 40% offshore cost-out
Siemens (2013) Wind power on its way to cost reduction
ORE Catapult (2015) Cost Reduction Monitoring Framework – Summary report to OWPB
The Crown Estate (2012) Offshore Wind Cost Reduction Pathways Study
Prognos (2013) Cost reduction potentials of Offshore Wind Power in Germany
European Commission (2014) Towards an Integrated Roadmap and Action Plan – Annex 1
European Wind Energy Technology Platform (2014) Strategic Research Agenda
TKI Wind Op Zee (2015) Cost reduction options for offshore wind in the Netherlands FID 2010-2020
BVG Associates (2015) Approaches to cost-reduction in offshore wind

[12] The Crown Estate (2013) Guide to UK Operations and Maintenance

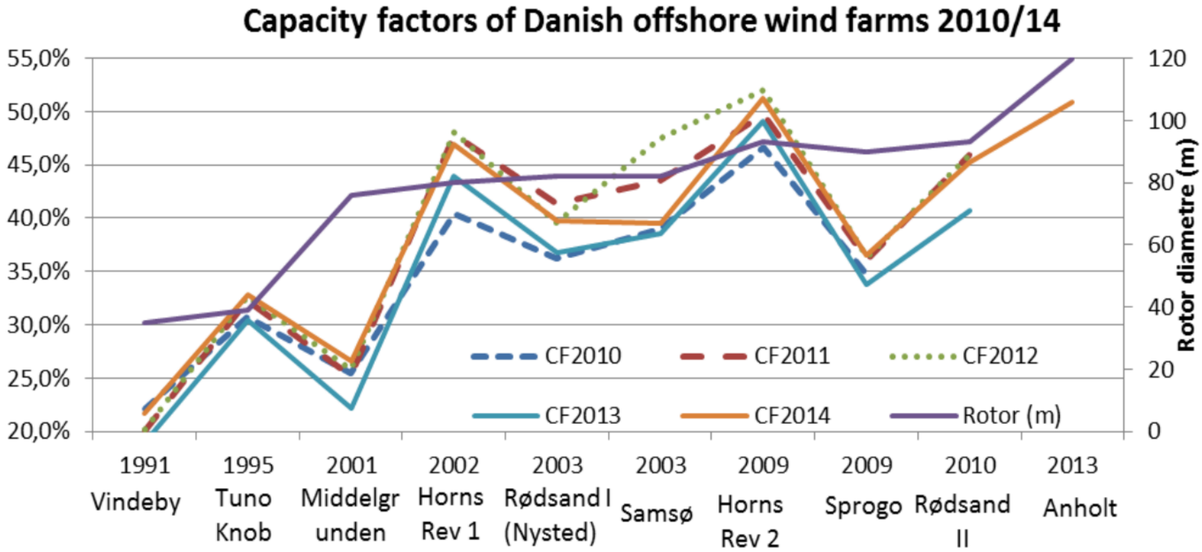

Figure 5: JRC (2014) Data showing capacity factors in Danish offshore wind farms related to the commissioning year. JRC further explains variability in capacity factor as due to 'good' wind years as well as specific power and rotor diameter[13].

Integrated wind energy systems including substructures

In March 2014, the European Wind Energy Technology Platform (TP Wind) set out in its Strategic Research Agenda a road map for priority areas in substructures which called for further development of innovative bottom fixed structures as well as floating designs and the accompanying optimization of installation methodologies. In addition, standardization in manufacturing and end-of-life / repowering developments. A summary of these is provided in the table below.

[13] European Commission JRC (2015) 2014 JRC Wind status report

	2020	2030	2050
Concept development	**Fixed** • XL monopiles (diameters >7m) commonly deployed • Jackets designed for serial fabrication • Suction buckets commercially deployed • Demonstration of self-installing concrete and steel structures (float out and sink) • New installation methods to reduce & mitigate piling noise **Floating** • Demonstration of spar buoy, TLP (Tension-Leg Platform), semi-sub structures in small commercial wind farms • Improved mooring and anchoring systems	• Fully integrated support structures – from seabed to nacelle – are common • Fixed foundations designed for >25-year life • Self-installing concepts have significant market share • Steel structures optimised for more competitive installation vessel market • Floating cost-competitive with fixed designs in lower depths • Novel designs – Demonstration of floating sub-structures to support novel turbine technologies,	• Novel fixed designs and floating designs
Design standards	• Improved design methods to - Extend **piled structures** into deeper waters - Enable **suction buckets** designs to be used • Allow installation in **challenging soil conditions**	• Methods allow fixed and floating substructures to support 10-20 MW turbines	• 20 MW+ machines, plus novel turbine technologies
Manufacturing	• Improved manufacturing - **Facilities** - **Processes and procedures** - **Technologies** • Increasingly **standardised components**	• Substructures use **standardised components** • **Facilities** exist in Europe to produce hundreds of foundations per year	• Mature market – final assembly in Europe
Operations and lifetime extension	• Improved corrosion protection • Improved condition monitoring to allow risk based maintenance • Optimisation of secondary steel (boat landings, cable protection systems)	• Methods to extend lifetime of substructures beyond 25-years • Lighter, stronger, cheaper materials used extensively	• Sophisticated lifetime extension programmes to increase lifetime to 35+ years
Repowering		First repowering of offshore wind farms	Repowering is common – substructures easy to decommission and to refurbish

Table 2: Targets for substructures from the European Wind Energy Technology Platform Strategic Research Agenda[14]

Final remarks

Overall, the wind industry supports the areas identified within the issue paper, which are broadly aligned with cost reduction targets[15]. Importantly, the de-risking of first-of-a-kind technology and innovation is a key component of cost reduction. Therefore, additional funding instruments may need to be established.

In addition believe the following efforts will improve reliability and production capability:

- Advances in condition monitoring, as well as research into materials that reduce leading edge erosion, would improve reliability as well as production.
- Alignment of testing methodologies across existing testing and certification providers, which could be implemented under a common test and validation centre or expansion and upgrade of existing facilities.
- Electrical performance and compliance testing for 33kV+ cables, particularly 66kV
- Facilities able to test and certify +100m blades
- Enhanced load test facilities for drive trains, including non-torque loads
- Support for FOAK (First of a Kind) technology deployment to reduce first-mover risk and promote innovation.

[14] ibid
[15] The Crown Estate (2012) Offshore Wind Cost Reduction Pathways Study
Prognos (2013) Cost reduction potentials of Offshore Wind Power in Germany
European Commission (2014) Towards an Integrated Roadmap and Action Plan – Annex 1
European Wind Energy Technology Platform (2014) Strategic Research Agenda
TKI Wind Op Zee (2015) Cost reduction options for offshore wind in the Netherlands FID 2010-2020

In addition to developers, utilities, and the supply chain, it will be important to bring into the discussion multiple stakeholders, including certifiers, insurance groups, test site operators, TSOs, and regulators in order to accurately define and implement the goals set out by the SET plan.

Early indication from preliminary industry consultation shows support for joint initiatives between multiple industry partners as well as the European Commission to secure Europe's position as 'Number 1 in renewable energy'.

The European wind industry looks forward to further consultation from the Commission and other stakeholders on the next steps, and to agree upon actions on the topics raised in Issue Paper No.1. We recognize communication with other members of the wind community such as academia and EERA are pre-requisites to further action.