KPMG

Offshore Wind: Ireland's Economic and Social Opportunity

A Report detailing how offshore wind can assist in Ireland's transition to a low carbon economy

November 2018

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Contents

1. Executive summary

1. Executive summary

This report considers the growing renewable energy demand in Ireland, the various technology options to meet this demand, and where and how offshore wind can be a key part of the solution.

Electricity demand growth

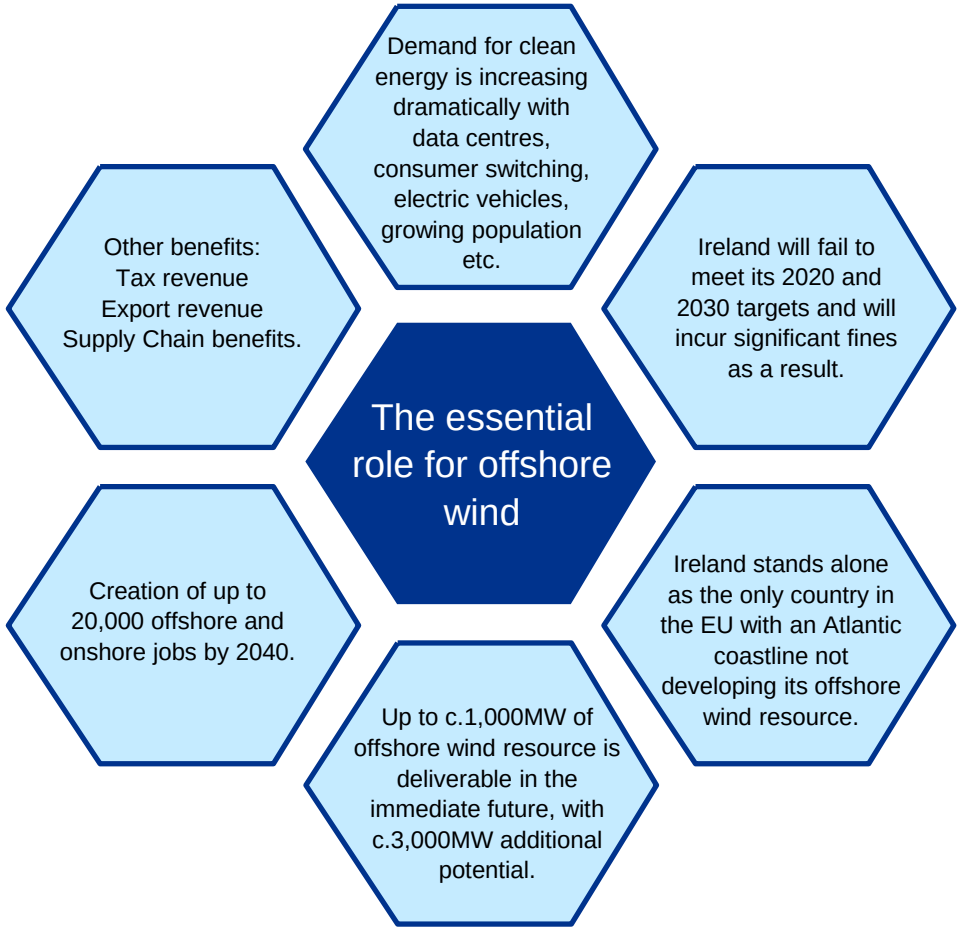
- Ireland is expected to experience strong, sustained growth in electricity demand between now and 2030. In an analysis of various future energy scenarios, EirGrid estimated that Ireland's total electricity requirement will increase by between 22% and 53% by 2030[1]. Key drivers of this growth in demand are expected to include:
  - **Economic Growth:** Significant economic growth is forecast generally, as well as specific growth in high energy industries, such as data centres and electric vehicles; and
  - **FDI:** Energy is increasingly being seen as a key criterion in attracting foreign direct investment and encouraging multinational companies to locate operations in a country.

Challenges in meeting this demand

- This increased demand must come from renewable sources in order to satisfy both national and EU targets, as well as CSR agendas of large corporates and FDI.
- Ireland has set a target that 40% of all electricity comes from renewable sources by 2020, rising to at least 55% by 2030, with many industry participants encouraging 75% by 2030[2].
- The EU has also set a separate target that 16% of all energy is to come from renewable energy sources by 2020, rising to 32% by 2030.
- SEAI analysis suggests Ireland will miss this 16% target, with the current trajectory suggesting it will only achieve 13% by 2020, which will likely result in EU fines[3].

The essential role of offshore wind

- Meeting the future renewable electricity demand, while also meeting EU renewable targets, will require Ireland to deploy between 400MW – 700MW of new renewable generation capacity per year, against a historic onshore wind deployment rate of c.200MW per year[4].
- While solar and onshore wind can and will play a role, offshore wind is the only technology with the scale and deployment capacity to meet this demand in full.
- Dramatic reductions in technology prices and improved performance now mean that offshore wind costs a fraction of historic pricing, with a trajectory to hit parity with other technologies in the short to medium term.



[1] *EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*
[2] *Decarbonisation of electricity in Ireland, A new roadmap, RECAP, November 2017.*
[3] *SEAI, Ireland's Energy projections, progress to targets, challenges and impacts, 2017.*
[4] *KPMG estimate.*

1. Executive summary

Offshore wind – economic and social benefits

- Ireland is the only European Union country with an Atlantic coastline which is not developing its offshore resource. Not only is this placing Ireland at an economic and competitive disadvantage, Ireland is missing out on a large number of associated economic and social benefits, including:
  - Providing significant volumes of renewable power relative to other technologies, which can meaningfully impact on our renewable energy targets;
  - It has been found in the UK economy that per 1,000MW installed, an economic boost of €2bn is expected[5]. The development of existing projects which have up to 4,000MW potential capacity would result in significant economic impact to the Irish economy;
  - Delivering significant employment, estimated at 20,000 new jobs (including onshore) by 2040, as well as very substantial additional investment according to SEAI[6];
  - Contribute, through the development of both fixed and floating wind projects, to the economic revitalisation of coastal areas, including the coastline of the west of Ireland whose sea basin is suitable for such development;
  - Enhancing Ireland's security of energy supply, which is increasingly topical given Brexit considerations;
  - Assist Ireland in meeting its commitment to the electrification of its transport system, which will not be possible without the volume of renewable power which the offshore industry can deliver;
  - Deployment of large-scale MWs close to the load centre (Dublin) would improve grid optimisation and reduce transmission costs;
  - Providing additional volumes of renewable power necessary to attract new foreign direct investment and to support the development of energy intensive industries; and
  - The location of turbines many kilometres out to sea has a low level of visual impact and virtually no noise impact on communities.
- Section 4 of this report considers the economic and social impact of offshore wind in detail.

Immediate impact

- There is a strong pipeline of offshore wind projects in the Irish sea. With clear Government support, these projects could deliver c.1,000MW of capacity in the immediate future that could help mitigate the 2020 fines. There is an additional c.3,000MW that could be delivered between 2020 – 2030.

Long term impact

- With appropriate policy support, Ireland can become an industry leader in the emerging area of floating wind, which is a particular technology where the western seaboard can experience significant benefit due to the nature of the sea basin and the large scale of the natural resource.
- In addition, once Ireland has achieved its targets for domestic renewable energy supply, there are significant opportunities in relation to interconnection and export. Such interconnection will support a higher penetration of renewable power onto the Irish grid and enable future exports.

[5] *ORE Catapult (2017), 'The economic value of offshore wind'.*
[6] *SEAI, Wind Energy Roadmap, 2011 – 2050.*

1. Executive summary

Policy recommendations

- In order to facilitate development of the Irish offshore wind industry and stimulate the required private sector investment, specific Government policy support is required.
- To ensure joined up work and action, it is proposed that the Government forms an Offshore Wind Development Committee on the model of the IFSC, where the Department of the Taoiseach plays a lead role, to bring together representatives of the relevant Government Departments and State Agencies and industry representatives, with a remit to oversee the work necessary to develop the offshore wind industry.
- Based on consultation with key industry participants, this report recommends the following policy initiatives:
  - The Government should develop a targeted policy for the development of the Irish offshore wind industry;
  - Inclusion of technology-specific support for offshore wind within the proposed renewable electricity support scheme (“RESS”);
  - Issue foreshore leases under the current Foreshore Act to enable Irish Sea projects to commence development in the immediate term, and introduce a Foreshore Amendment Act dealing with offshore wind; and
  - Implement a specific offshore wind grid connection round for Irish Sea projects.
- These policies would facilitate existing projects and provide a stimulus to the industry for future projects, enabling immediate investment and activity in the sector. All of the suggested policies can be implemented in the short term.
- Section 5 of this Report considers these policy recommendations in more detail.

1. Executive summary

Offshore wind – The Fundamentals

- Ireland has all the necessary capabilities required to create a vibrant industry. All that is required is the necessary Government policy to kick-start the industry.

Existing capabilities

- Offshore wind resource ✓
- Availability of capital ✓
- Developer / Utility capabilities ✓
- Cost of deployment falling ✓
- Support services ✓
- Market for offshore wind ✓
- Government policy* ✓

Headline benefits

- Economic opportunity
- FDI benefits
- Achieving climate change objectives
- Electrification of transport
- Social and community benefits
- EU 2020 / 2030 Targets

**See policy recommendations outlined in section 5.*

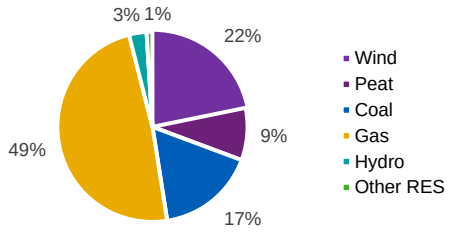
2. Growth in renewable energy demand in Ireland

2. Growth in renewable energy demand in Ireland

Demand for renewable energy is expected to grow materially over the next 30 years

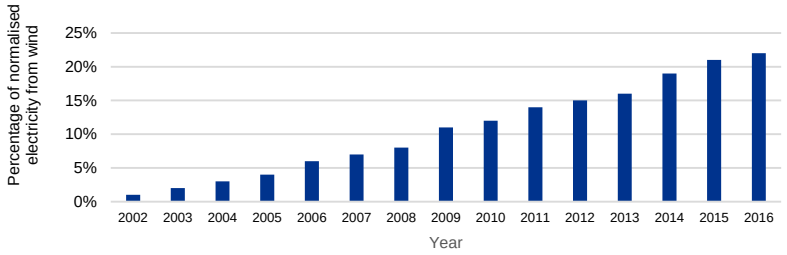
- Ireland has a strong and proud history of renewable energy investment, having embraced renewable generation since the late 1990s, with renewables accounting for over 26% of the electricity generation fuel mix in 2016.

Figure 2.1: Electricity generation fuel mix in Ireland in 2016[7]



- The majority of this renewable generation currently comes from onshore wind, which has successfully deployed more than 3,600MW[8] of capacity in the past 18 years, accounting for c.90% of renewable capacity in Ireland today.

Figure 2.2: Normalised electricity from wind[9]



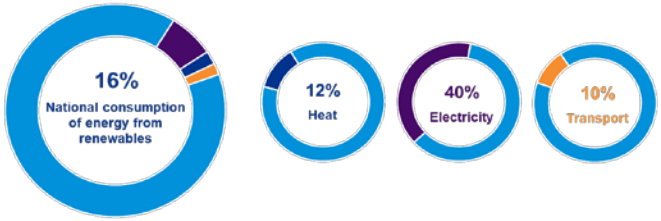
- Despite this strong progress, a combination of increasingly demanding EU targets, together with growth in consumer and industrial demand, means that Ireland must invest further in renewable energy if it is to meet future renewable generation targets and satisfy expected future growth in demand from energy users.

- This section of the report investigates the key drivers of demand for renewable energy.

EU targets

- Key drivers of growth in renewable energy to date and going forward are the various EU energy targets adopted by Ireland.
- The EU has set a binding target for Ireland to source 16% of all energy from renewable sources by 2020, with Ireland setting a sub-target of 40% electricity from renewable sources by 2020.
- Ireland has the highest level of greenhouse gas emissions of all 27 member states per capita, and is facing increasing political pressure from the EU to take action in relation to renewable energy targets.[10]

Figure 2.3: EU 2020 renewable targets



- It is estimated that Ireland will be one of only two Member States to miss these targets, which the Government has accepted the country will not meet. This will result in EU fines of up to a reported €600million[11].
- The target will rise to 32% by 2030[12], and as a nation Ireland needs to start planning now given the timescales involved.
- The requirement for countries to shift their reliance on carbon energy resources is being set at a global as well as EU level, with national obligations committed to in both the 2015 Paris Agreement and the UN's Sustainable Development Goals (SDGs) initiatives. Ireland is a signatory to both of these initiatives, and the Minister for Communications, Climate Action and the Environment recently launched the first National Implementation Plan for SDGs.

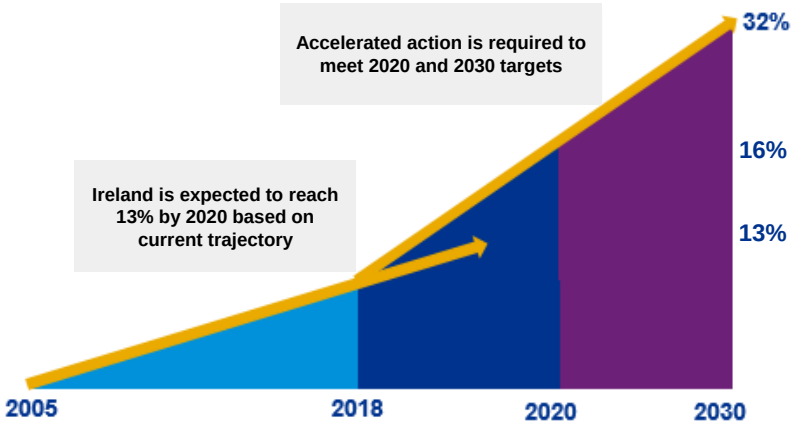
[7] *page 14, EirGrid, All Island generation capacity statement, 2017 – 2026.*
[8] *'Tomorrows Energy Scenarios', presentation by EirGrid, at National Power Summit 2018.*
[9] *page 44, EirGrid, All Island generation capacity statement, 2017 – 2026.*
[10] *'Ireland ranks worst in Europe on Climate Change index', Irish Times, 15 November 2017.*
[11] *'Ireland faces annual EU energy fines of €600m', Irish Independent, 30 April 2018.*
[12] *'Commission welcomes ambitious agreement on further renewable energy development in the EU', European Commission, available at http://europa.eu/rapid/press-release_STATEMENT-18-4155_en.htm.*

2. Growth in renewable energy demand in Ireland

Demand for renewable energy is expected to grow materially over the next 30 years

- Since 1997, Ireland has achieved a historic build-out rate of c.200MW of renewable capacity per year. As outlined in the graph below, based on current build-out trajectory, Ireland will miss its 2020 renewable energy target of 16% by 3%.
- In order to meet the electricity component of the proposed 2030 renewable energy target of 32%, Ireland will need to substantially increase its renewable capacity build-out rate to an equivalent of between 400MW – 700MW of additional capacity per annum[13].

Figure 2.4: Trajectory to 2020 and 2030 targets



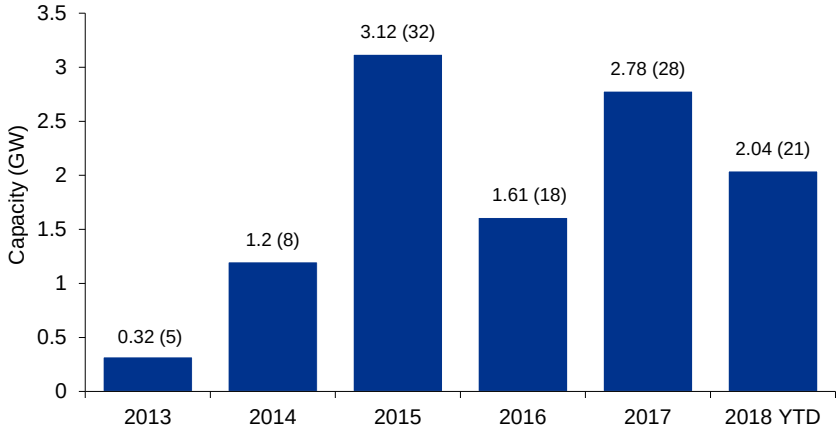
*Not to scale

- With the closure of the REFIT schemes to new projects and delays in implementing its successor, RESS, along with significant challenges in gaining grid connections or planning permission for onshore wind, there has been a reduction in renewable energy deployment in recent years, which is likely to continue for the foreseeable future.

Market demand

- While Government targets historically represented the main driver of growth in renewable energy demand, increasingly corporate social responsibility agendas within businesses, pricing certainty, as well as environmentally-conscious consumers are creating the demand for renewable energy globally.
- For example, the RE 100 Club, an organisation containing many of the largest and most influential global corporations, have made a commitment to 100% renewable electricity. Many of the members of RE 100, such as Coca Cola, Apple and Facebook, have established operations in Ireland and require Ireland to satisfy their renewable energy requirements.[14]
- As shown in the graphic below, demand for corporate renewable power in the US grew by more than 800% between 2013 and 2017, with 2018 set to create a new record. The companies contracting corporate PPAs include Microsoft, Facebook, Google, Apple, Proctor & Gamble, all of whom have significant presences in Ireland, and have a growing demand for the same in this jurisdiction.

Figure 2.5: US corporate renewable energy demand [15]



[13] *KPMG estimate*

[14] *http://there100.org/companies*

[15] *Publicly announced capacity of corporate Power Purchase Agreements, Green Power Purchases, Green Tariffs, and Outright Project Ownership in the US, 2013 – 2018 YTD, Excludes on-site generation (e.g. rooftop solar PV) and deals with operating plants. (#) indicates number of deals each year by individual companies. Source: Rocky Mountain Institute*

2. Growth in renewable energy demand in Ireland

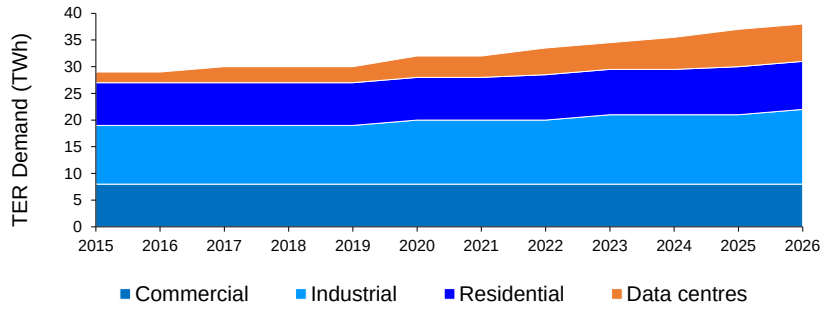
Demand for renewable energy is expected to grow materially over the next 30 years

- Access to sufficient renewable energy is becoming an increasingly important factor in attracting FDI to Ireland. In particular, data centres represent a particularly compelling FDI opportunity for Ireland.

Data centres

- Ireland has become a hub for data centres in recent years, with large technology companies such as Facebook and Amazon setting up major European data storage facilities.
- The country is seen as an attractive location for the facilities for a range of reasons, including the cooler climate and strong connectivity to the US via transatlantic data cables.
- The final requirement is access to sufficient renewable energy to run the facilities. These companies have a specific requirement that all energy requirements for data centres are met from 100% renewable sources.
- As shown in the graphic below, EirGrid forecasts data centres could represent a core driver of growth in energy demand, representing up to 15% of electrical demand by 2026.

Figure 2.5: Growth in Irish energy demand[16]



- Given that data centres consumed 22% of all Irish renewable generation in 2016, if deployment reaches 1,100MW by 2024 as expected, this one sector would consume more than 60% of today's renewable generation capacity.
- In order to just maintain current progress on EU targets, data centres alone will dictate that Ireland requires more than a 1,000MW of additional renewable capacity to be deployed by 2020, before taking into account the future rises in EU targets[17].

Electrification of vehicles & heating

- Ireland is currently set to miss its 2020 renewable energy targets in relation to both the transport sector (12%) and residential heating (10%).
- While there are a number of initiatives being progressed, the Government has set a target of 50,000 electric vehicles by 2020, and is considering electrification of heating within certain homes[18].
- Both of these initiatives will require a very significant increase in electricity generation capacity, which must come from renewable sources in order to achieve the required benefits.

Overall demand increases

- In an analysis of various future energy scenarios, EirGrid estimate that Ireland's total electricity requirement will increase by between 22% and 53% by 2030[19].
- Under these various demand growth scenarios, and considering the further decarbonisation of existing electricity supply required, KPMG estimates that Ireland will require between 400MW – 700MW of additional generating capacity per annum to satisfy the electricity component of the 2030 renewable energy target[20].

[16] *page 39, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*

[17] *page 5, Data Centre implications for Energy use in Ireland, IWEA, Callaghan Engineering.*
[18] *page 31, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*
[19] *page 28, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*
[20] *KPMG estimate*

3. The need for offshore wind in Ireland

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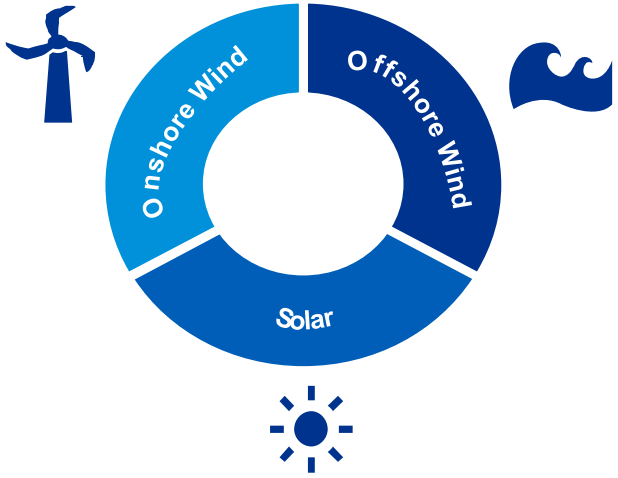
Offshore wind is an essential component of Irish energy generation mix if Ireland is to meet future renewable energy demand

- Having established that Ireland will experience significant growth in renewable energy demand from both consumers and EU targets, and that it is vital to Ireland's economic and global competitiveness that this demand is satisfied, this section of the report considers the need for and role that offshore wind can play in meeting this demand.

Future technology mix

- Within this report, we consider three core technologies that we expect to play a role in meeting future renewable energy demand.



- While a number of other technologies exist, including biomass CHP, hydro and marine energy, lack of proven technology or limited deployment potential means we have excluded them from this report.
- For each technology we consider its current status, near and long-term deployment potential, as well as the economic considerations of each technology.

Onshore wind

Current status

- To date, onshore wind has dominated the Irish renewable sector, with over 250 wind farms providing in excess of 3,600MW of generation capacity.
- Onshore wind has historically represented the lowest cost renewable option available in Ireland, utilising a strong wind resource, proven technology and local grid access to deliver vital renewable generation capacity.
- The onshore wind industry has enjoyed strong policy support over the past decade through both REFIT I and II schemes, and has attracted billions of euros of investment into Ireland.

Near-term deployment potential

- Despite strong historical deployment of the technology, as outlined on page 10, the onshore wind industry has proven unable to keep pace with the increased deployment rate required to meet the 2020 targets, with a number of core issues severely impacting the industry's ability to deliver near-term capacity, including:
  - Closure of existing subsidy schemes to new projects and delays in introducing replacement programmes;
  - Significant delays in gaining planning permissions, including increasing local resident and council objections; and
  - Delays in obtaining grid connections.

3. The need for offshore wind in Ireland

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Long-term deployment potential

- While near-term deployment potential appears limited, the onshore industry is confident that there remains a considerable onshore wind resource available, so long as it can be appropriately accessed. According to SEAI, Ireland has a theoretical wind resource of 12,000MW, with c.8,000MW between operational, construction and sites under consideration.
- That said, despite a strong potential resource, based on historical deployment rates, together with increasing deployment challenges, onshore wind is highly unlikely to be able to be deployed at a sufficient rate to meet future demand and EU targets.
- Historically, the onshore wind industry has achieved an average of c.200MW of deployment per annum. In order to meet expected demand and 2030 targets, the industry needs to deploy up to 700MW per annum. This material increase would need to be met against a backdrop of increased local objection, increased minimum setback distance from housing, tighter limits on shadow flicker and noise. Furthermore, it is likely that land availability for onshore wind will be reduced when new guidelines are published by the Government, which is expected to happen in 2018.
- In conclusion, while onshore wind will continue to provide a valuable and important contribution to future renewable energy capacity, it will fall significantly short of meeting future demand on its own.

Solar

Current status

- Solar PV in Ireland remains embryonic, with only c.1MW of ground mounted solar PV currently deployed. Within Northern Ireland, there is c.200MW of installed capacity (and therefore captured in the all-island energy market). However, closure of the ROC scheme means further capacity in the short-medium term is unlikely.
- Despite limited deployment, Ireland has an active and experienced solar developer ecosystem, with significant investment being made in progressing projects to a construction-ready stage.

Near-term deployment potential

- While more than 5,000MW of capacity has been submitted into planning, there is currently very limited shovel ready solar capacity in Ireland, with less than 200MW of projects with both planning and grid connection offers. Furthermore, despite significant reductions in PV pricing in recent years, the Irish industry still requires support to make it economically viable, and as such delays in the implementation of RESS has impacted on the pace of investment activity in the sector.

Long-term deployment potential

- Whilst solar PV will be an important component of the technology mix, it is clear it will not be sufficient to meet our renewable energy requirement on its own. In future energy scenarios, EirGrid considered a number of scenarios, ranging from 200MW to 2,500MW by 2030[21]. Given the lower capacity factor of solar, even if the upper end was delivered, it would only be equivalent to 625MW of offshore wind and far short of the new capacity required by 2030.

[21] *page 70, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*

3. The need for offshore wind in Ireland

Offshore wind is an essential component of Irish energy generation mix if Ireland is to meet future renewable energy demand

Offshore Wind

Current status

- Despite significant industry investment and activity over the past decade, and Ireland having one of the leading offshore wind resources in Europe, to date there has only been 25MW of offshore capacity deployed, located within the Arklow Bank project.
- This leaves Ireland as the only EU country with an Atlantic coast which is not developing its offshore wind resource.
- The offshore wind industry believes an absence of Government policy has been an impediment to progress in recent years.
- Despite historic delays, there is now renewed optimism from offshore investors, who recognise the vast offshore resource Ireland holds. In the past 12 months alone, two new international investors have committed capital to existing Irish development projects with the potential for further future investment.
- In its recent future technology review, EirGrid noted that "*It is also very likely Ireland will require some additional offshore wind generation to meet future decarbonisation targets*".[22]

Near-term deployment potential

- Ireland has very significant near-term offshore deployment potential so long as the appropriate policy support is provided.
- The scale of offshore wind farms, being in the hundreds of megawatts, can achieve greater generation capacities and economies of scale compared to onshore farms.
- Offshore projects based on the east coast of Ireland are located close to the demand centre of Dublin, therefore significantly reducing transmission costs.

Figure 3.1: Irelands offshore wind resource is 10 times the size of its landmass[23]

**Map is indicative only and is not to scale*

[22] *page 51, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.*
[23] *NOW Ireland*

3. The need for offshore wind in Ireland

Offshore wind is an essential component of Irish energy generation mix if Ireland is to meet future renewable energy demand

- The core near-term pipeline for offshore wind consists of a number of major projects, each of which has invested millions of euro to gain the required consents, design parameters and environmental considerations to allow near-term deployment. Between the various projects outlined below, there is the potential to deliver in the immediate future 1,000MW of capacity that could reduce the scale of the 2020 fines, and in the 2020-2030 period an additional 3,000MW that would contribute significantly to Ireland's renewable electricity requirement for 2030.

Oriel Windfarm

- Scale: Consent for 55 turbines East of Dundalk Bay. 330MW.
- Status: Conditional consent.

Dublin Array

- Scale: Application for 145 turbines on the Kish/Bray Banks. 725MW.
- Status: Application in process.

Codling Wind Park

- Scale: Lease for 220 turbines on the Codling Bank. Application for a further 200 turbines. Up to 2,100MW.
- Status: Consented.

SSE Renewables – Arklow Banks

- Scale: Lease for 200 turbines on the Arklow Bank with minimum potential of 520MW of capacity.
- Status: Consented.

North Irish Sea Array

- Scale: Up to 750MW.
- Status: Detailed site assessments and environmental and technical constraint analysis carried out that show its suitability for an offshore wind farm.

ESB

- ESB-owned Hibernian Wind Power has applied for two investigative foreshore licences, aiming to examine the feasibility of building two 500MW offshore wind farms off Ireland's East Coast.

Deployment potential in the years ahead

- Ireland has enormous potential for offshore energy developments in the years ahead. The Offshore Renewable Development Plan report[24] outlined the potential for 12,500 MW of fixed offshore wind generation and 27,000MW of floating offshore wind generation off Ireland's coast.[25]
- In the near term, 1,000MW is deliverable immediately, and a further 3,000MW is deliverable between 2020 and 2030.
- Offshore wind benefits from being one of the most efficient forms of renewable energy technologies. For example, 1,000MW of offshore wind will result in a greater energy output than 1,000MW of other renewable energy classes such as solar due to the efficiency of the technology. This capacity provides the ability for Ireland to meet future forecasted demand through to 2030 and beyond, which simply cannot be achieved without offshore wind as part of the future energy mix.

[24] Department of Communications, Climate Action and Environment Offshore Renewable Energy Development Plan – February 2014.
[25] page 51, EirGrid, Tomorrows Energy Scenarios 2017, Planning for our Energy Future.

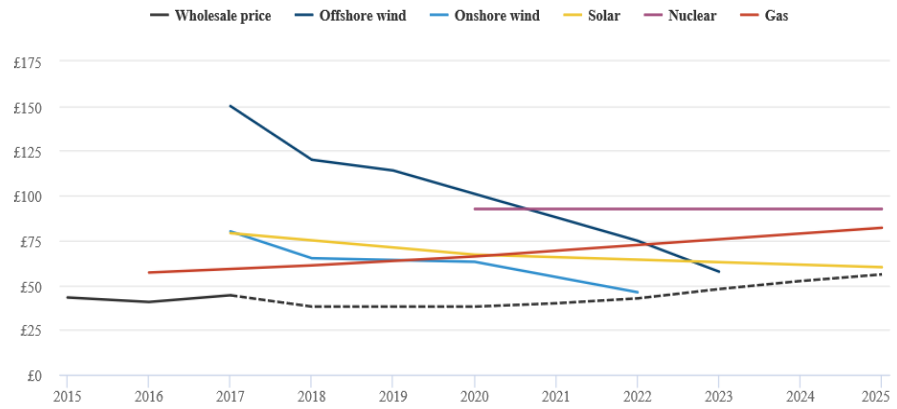
3. The need for offshore wind in Ireland

Offshore wind is an essential component of Irish energy generation mix if Ireland is to meet future renewable energy demand

Renewable energy economic considerations

- Due to higher technology costs, all renewable energy generation in Ireland has historically relied on Government support, primarily the REFIT schemes, funded through the PSO levy.
- While this remains the case, as outlined in the graph below, overall costs of technology have fallen dramatically in recent years across all technologies, due to both technological improvements and economies of scale. As such, it is expected that the level of future subsidy support required will drop across all technologies.

Figure 3.2: UK Historic and Forecast Electricity costs by technology [26]



- There is strong evidence that despite the requirement for support, deployment of zero marginal cost technologies, such as onshore and offshore wind, actually lowers overall costs to consumers, even when taking into account the PSO levy.
- For example, a recent Poyry report entitled "*Future Energy Scenarios*" noted that the merit order effect pushed down prices by more than the predicted subsidy level. This is further supported by a number of EirGrid, SEAI and EU studies. Most recently, the rating agency, Moody's, noted that "*low prices of energy will reflect the continued growth of onshore wind power*" [27].
- As such, while the following pages assess the relative future costs of particular technology options, it is worth noting that despite prices being above current wholesale prices, this will not necessarily feed through into higher prices for the consumer.

[26] *BEIS projections, CfD auction results and Baringa Partners. Chart by Carbon Brief .*

[27] *Onshore wind to keep Irish power prices low for five years, says Moody's, Irish Times, 22 November 2017.*

3. The need for offshore wind in Ireland

Offshore wind costs are reducing and it is now competitive with other technologies in some European markets such as the UK

Offshore wind costs in other markets

- This section looks at the economics of recent offshore wind projects in other European countries, as well as for onshore wind and solar.
- While offshore wind has historically cost significantly more than other renewable technologies, with the 2009 Walney project in the UK, for example, costing over €150 / MWh[28], this has fallen dramatically over recent years, with recent projects falling to €65 / MWh and below, and some European projects requiring no subsidy at all.
- Recent experience shows substantial falls in the price of offshore wind in competitive auctions, such that it is approaching parity with other leading renewable technologies.

United Kingdom

- The support required by offshore wind in the UK has fallen sharply in recent years, as evidenced by falling strike prices for Contracts for Difference (CfDs).
- Prior to the introduction of CfDs, offshore wind was supported under the Renewables Obligation (RO). Projects that were commissioned under the RO received 2 Renewable Obligation Certificates (ROCs) for each MWh. The value of a ROC for 2018/19 is £47.22. An offshore wind farm in receipt of ROCs would therefore be receiving £145/MWh at current wholesale prices. The RO closed to new entrants in 2017[27].
- Under CfDs, low-carbon generation receives a constant 'strike price' for every MWh produced. The strike price comprises both market revenue and a subsidy element (calculated as the difference between the strike price and the wholesale price).
- The September 2017 CfD allocation results for the UK are illustrated in Table 3.2.

Table 3.1: Lowest achieved auction prices by technology in European markets[28]

Technology	Country	€/MWh	Auction date
Offshore wind	Germany	Wholesale price only	2017
	UK	65.60	2017
	Netherlands	54.50	2016
Solar	UK	57.00	2015
	Germany	49.00	2017
	France	55.50	2017
	Spain	33.00	2017
Onshore wind	Germany	38.20	2017
	Spain	33.00	2017

Table 3.2: Contracts for difference September 2017 allocation results in UK[29]

Project Name	Capacity (MW)	Stike Price (£/MWh)	Initial phase year of delivery
Triton Knoll Offshore wind farm	860	74.75	2021 / 22
Hornsea Project 2	1,386	57.50	2022 / 23
Moray Offshore wind farm (East)	950	57.50	2022 / 23

[28]Strike prices and capacity data available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/407465/Breakdown_information_on_CFD_auctions.pdf and https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643560/CFD_allocation_round_2_outcome_FINAL.pdf

[29]ROC revenue is earned in addition to the wholesale price. Average wholesale price was £50.84 for January 2018. Further information available at https://www.ofgem.gov.uk/data-portal/electricity-prices-day-ahead-baseload-contracts-monthly-average-gb

3. The need for offshore wind in Ireland

Offshore wind costs are reducing and it is now competitive with other technologies in some European markets such as the UK

Germany

- In April 2017, the German government's Federal Network Agency announced the result of its first auction, which provided subsidies for offshore wind producers in the North Sea. Three of the four successful projects were delivered without revenue support, and will receive wholesale market revenues only when completed. The results of the auction are summarised in Table 3.2.

Other countries

- Auctions in other European countries have also shown a downward trend in prices. In the Netherlands, the Borssele 3&4 project secured a strike price of €54.50/MWh in 2016, after Borssele 1&2 had secured €72.70/MWh earlier in the year. In Denmark, the Krigers Flak project secured a strike price of €49.90/MWh in 2017, after Vester Syd & Nord had secured €72.70/MWh in 2016.[30]
- There are variations in support regimes across countries, which mean strike prices cannot be directly compared. For example:
    - In the Netherlands, Denmark and Germany, wind farms do not pay the costs of transmission connection, whereas UK developers face these costs and look to recover them through the strike price;
    - UK strike prices are linked to inflation, whereas this is not the case in the Netherlands, Denmark and Germany;
    - Auctions in the Netherlands and Denmark are for pre-developed sites, so strike prices do not reflect pre-development costs.

Table 3.2: Recent offshore wind auction results[31]

Project	Capacity (MW)	Strike price (€/MWh)	Delivery year
He Dreiht	900	Market revenue only	2025
OWP West	240	Market revenue only	2024
Borkum Riffg W 2	240	Market revenue only	2024
Gode Wind 3	110	60	2023

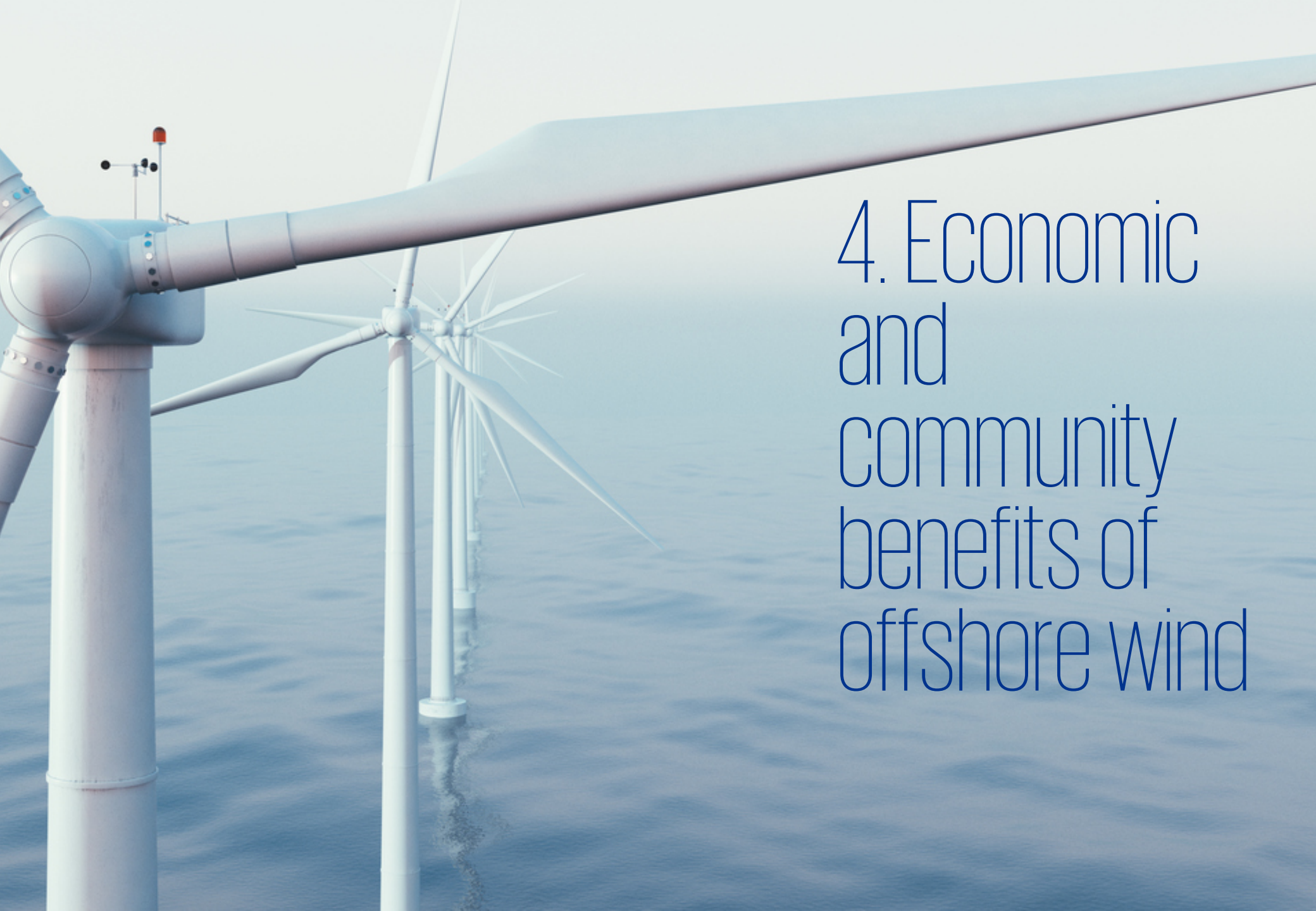
[30] *Sandbag and Agora Energiewende (2018), 'The European Power Sector in 2017'.*
[31] *Auction results available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643560/CFD_allocation_round_2_outcome_FINAL.pdf.*

3. The need for offshore wind in Ireland

Offshore wind costs are reducing and it is now competitive with other technologies in some European markets such as the UK

Summary

- As evidenced in this section, the cost of offshore wind has decreased dramatically and is likely to fall further. Further to this, costs are falling as turbines are getting more efficient. In order to achieve a lower LCOE, the Government should allow those near term projects to utilise the most efficient and up-to-date technology.
- Ireland will now be the beneficiary of the falling costs, as the amount of support will be significantly reduced. In addition, the capacity factors of offshore wind projects are significantly higher than other renewable energy technologies meaning greater efficiencies can be achieved.
- This is very relevant given the likely increase in demand for green power which now appears to be inevitable. Therefore, cost can no longer be used as the principal reason for not creating an offshore wind regime in Ireland.



4. Economic and community benefits of offshore wind

4. Economic and community benefits of offshore wind

The significant economic benefits include employment, regional development, balance of trade and security of energy supply

- The development of an offshore wind sector can offer significant economic and community benefits to the Irish economy. These can take the form of supply chain development and innovation, employment in installation and operation, attracting turbine manufacturers' inward investment in manufacturing facilities into the country and the creation of new businesses (particularly SMEs).

Scale of macroeconomic benefits

- Given the scale of investment required in the development of offshore wind, significant investment in projects around the country will have a meaningful impact on economy from a macro perspective.
- As a comparison, multiple studies in the UK economy have shown a positive macroeconomic effect from investing in offshore wind generation. These include:
    - An ORE Catapult study estimated Gross Value Added (GVA) to the UK per GW installed at £1.8bn in 2017[32].
    - A report by Cambridge Econometrics found that, compared to a future system relying on gas, large-scale investment in offshore wind would see a GDP increase of 0.8% by 2030, and 70,000 additional jobs[33].
- Given Ireland's abundant natural resource, particularly off the Western seaboard, a similarly equivalent economic boost is achievable in line with what has been found in the UK economy. The development of existing projects, which have up to 3,000MW of potential, would result in major economic impact to the Irish economy.

Economic impacts of offshore wind

- The delivery and operation of offshore wind sees flows of capital and operational expenditure to multiple sectors of the economy through the project lifecycle. Many of these sectors are high-skilled, as shown in Table 4.1.
- In addition to development and consent, installation and commissioning, and operations and maintenance, the UK economy has targeted attracting investment from major turbine manufacturers to locate their manufacturing plants within the country. Ireland has a similar opportunity to attract large turbine manufacturers if a vibrant industry is developed, with the potential to create manufacturing jobs in rural parts of the economy.

Table 4.1: Employment opportunities within the offshore wind development industry

Development Stage	Industry sectors to which capital expenditure flows
Development and Consent	Accounting and tax consultancy Architectural and technical consultancy Environmental consultancy Financial services Foundation Technology Scientific research and development Water and air transport
Wind Turbine	Electrical components manufacturing Fabricated metals manufacturing Hydraulic components manufacturing Iron and steel manufacturing
Balance of Plant	Concrete manufacturing Iron and steel manufacturing Marine construction Wiring and cables manufacturing
Installation and Commissioning	Marine construction Water transport
Operations and Maintenance	Electricity generation Fabricated metals manufacturing Marine construction IT, water and air transport

[32] *ORE Catapult (2017), 'The economic value of offshore wind'.*
[33] *Cambridge Econometrics (2012), 'A study into the economics of gas and offshore wind'.*

4. Economic and community benefits of offshore wind

The significant economic benefits include employment, regional development, balance of trade and security of energy supply

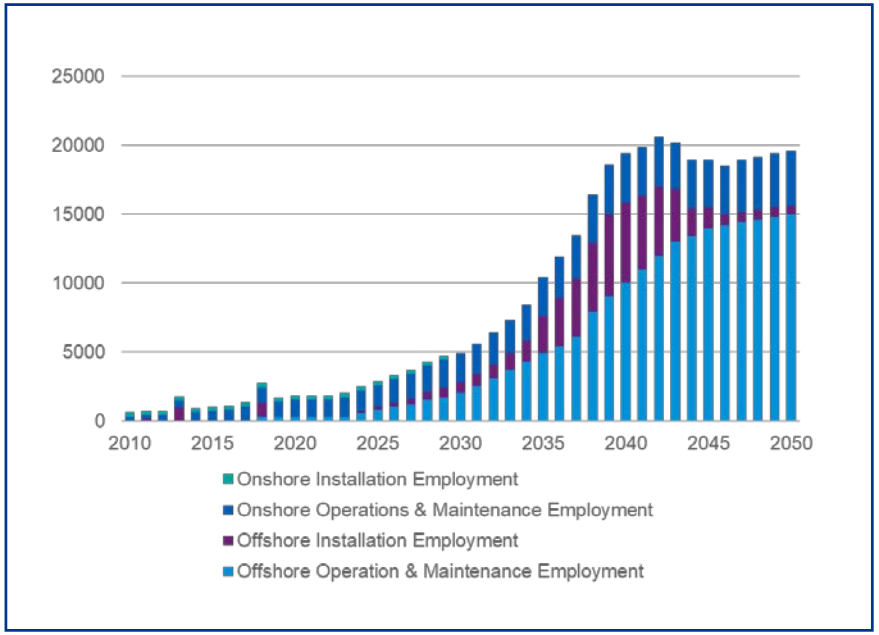
Regional economic benefits

- Offshore wind projects aid the regeneration of regional economies. Given the scale of investment required to develop the projects, the regional employment and multiplier effect to supply chains and local communities is very significant. In addition, it creates the potential of attracting manufacturing jobs if manufacturers locate plants within the areas.
- The Sustainable Energy Authority of Ireland have estimated that onshore and offshore wind generation could create over 20,000 direct installation and operation and maintenance jobs by 2040, as illustrated in Figure 4.1. These jobs would be predominantly created in areas of Ireland with low employment density, such as the western seaboard and the east coast outside the greater Dublin area.
- A notable example from the UK is that in March 2014, Siemens Gamesa and Associated British Ports (ABP) announced a major investment of £310m for the development of an offshore wind turbine blade manufacturing facility on Alexandra Dock in Hull. An impact assessment carried out by the University of Hull estimated that the plant created 1,063 jobs, with the potential for an additional 627 support jobs. The scheme has also had a positive impact on local skills, with 780 apprenticeships created as of 2017/18, and a large increase in NVQ engineering qualifications from 2012/13 to 2017/18.[34] If Ireland was to develop its industry here, it is likely that the country would attract investments of a similar nature.

Security of supply impacts[35]

- The majority of Ireland's energy requirements are imported (69% in 2016).[36] The energy produced domestically is reliant on finite resources such as the Corrib and Kinsale gas fields, and peat burning generation stations.
- Offshore wind creates significant benefits from a security of energy supply perspective. If offshore wind, sourced from within Ireland's territorial waters, substitutes natural gas, and coal in the electricity generation sector, Ireland's fossil fuel imports will be reduced. A generation sector that is less dependent on fossil fuels offers some protection against volatility in future international fossil fuel prices. In addition, it increases the diversity of Ireland's generation mix, making it easier to manage the risks associated with particular technologies.

Figure 4.1: Annual Onshore and Offshore Wind Employment Figures for Ireland to 2050.[37]



[34] *University of Hull (2017), 'Green Port Hull - Skills and employment impact'.*
[35] *Wind Energy Roadmap 2011-2050, Sustainable Energy Authority of Ireland.*
[36] *Energy in Ireland 1990 – 2006, 2017 Report, SEAI*
[37] *Graph from ORE Catapult (2017), 'The economic value of offshore wind'.*

4. Economic and community benefits of offshore wind

The significant economic benefits include employment, regional development, balance of trade and security of energy supply

Exports and balance of trade

- Investment in the offshore wind supply chain creates possibilities for export of goods, services and skills as other countries develop their offshore wind sectors in the future. Europe is the current leader in offshore wind development. European countries are expected to install up to 9,000MW by 2020, with additional growth beyond this. Development is also picking up in Asian economies and the United States.
- After Ireland's domestic renewable requirements are achieved, additional power generated by offshore wind projects can also be exported to other markets as interconnection is developed. The scale of benefits will depend on the extent of interconnection, i.e. greater interconnection capacity will allow more electricity to be exported at times when supply is tight (and prices high) in the overseas market.
- A number of existing projects are well underway to realise this opportunity, and it is well recognised that interconnection in itself brings many economic benefits to Ireland, including price stability, security of supply and a whole new export market. Given its potential for offshore wind development, Ireland could soon be a net exporter of power to Europe.
- Offshore wind is a critical part of the overall solution for interconnection, as it will ensure that sufficient green power is produced to meet the needs of the domestic Irish market and can also provide a surplus for the export market.
- In addition, the concept of a North Western European super grid project is now gaining currency and has the support of many significant organisations throughout the European Union. The overall effect of the super grids proposal is to bring offshore wind into all of the North European markets through a multilateral grid system. If Ireland does not quickly accelerate its transition to offshore wind, we run the risk of not being part of the overall super grid project with its resulting economic benefits.[38]

Lower levels of visual and noise impact relative to other technologies

- A significant challenge in the large scale roll out of renewable energy technologies in Ireland (as well as other countries) is striking the balance between developing renewable energy projects at scale whilst ensuring the impact on local communities is positive.
- In Ireland, offshore wind turbines are located 7-10km from the nearest shoreline. As a result, the visual impact is considerably less when compared to onshore, and noise impact is not an issue.[39]

Benefits of increased renewable energy volumes

- As discussed in section 2 and section 3 of this report, Ireland has an increased and growing demand for renewable energy. The scale to which offshore wind can assist Ireland in meeting this demand and thereby increasing our overall renewable energy supply will have the benefits of:
    - Assist Ireland in meeting its 2020 and 2030 EU targets, and avoiding significant fines or alternatively the cost of statistical transfers;
    - Assist Ireland in meeting its commitment to the electrification of its transport system, which will not be possible without the volume of renewable power which the offshore industry can deliver;
    - Enabling Ireland to take its own responsibility for climate change and help meet its commitments under the Paris Agreement and Sustainable Development Goals, given the scale of projects and their ability to contribute to our renewable energy requirements; and
    - Providing additional volumes of renewable power necessary to attract new foreign direct investment and the support the development of energy intensive industries.

[38] *Commission for Regulation of Utilities (2017), 'Grid Connections for Electricity Interconnectors'.*

[39] *Visual Impact, NOW Ireland. Available at http://nowireland.ie/visual-impact/.*

5. Specific policy recommendations

5. Specific policy recommendations

A number of key recommendations can be implemented quickly to realise the economic and social benefits

- Following consultation with key industry participants, we believe specific Government actions are necessary to help develop an indigenous offshore wind industry. Four particular areas where action is required include:
    - Develop a targeted policy for offshore wind;
    - Technology-specific support systems;
    - Foreshore leases; and
    - Grid connections.
- The action requirements in respect of these areas include:

1. **Develop a targeted policy for offshore wind:** The Government should develop and communicate a targeted policy for the development of an indigenous offshore wind industry, in line with most EU countries. The Government should then support the relevant Government Departments and State Agencies to implement that policy.
2. **Technology-specific support systems:** The Government is currently designing the structure of the next support scheme, RESS, with an announcement expected in the coming months. We believe a technology specific support system for the offshore wind technology will provide greater certainty for the industry, which in turn would stimulate investment activity in the sector.
3. **Foreshore leases:** Foreshore leases can be granted under the existing Foreshore Acts and implemented by the Department of Housing, Planning and Local Government. The relevant Division within the Department should be mandated to prioritise the actions necessary to deliver the pipeline of Irish Sea projects and to implement that action, including a Foreshore Amendment Act.
4. **Grid connections:** Grid connections are the responsibility of the Energy Regulator - CRU, and EirGrid, with oversight by the Department of Communications Climate Action and Environment. The relevant Divisions should identify the action necessary to deliver the pipeline of Irish Sea projects, which may involve a specific offshore connection round or gate, and to subsequently implement that action.

Joined up Government approach required

- The various Departments and Agencies involved in the areas requiring action to develop the offshore wind industry include:
    - Department of Communications, Climate Action and Environment;
    - Department of Housing, Planning and Local Government;
    - Department of Finance and the Public Expenditure;
    - Energy Regulator CRU; and
    - EirGrid.
- Based on KPMG's consultation with key industry participants, delivering on the suggested policy recommendations would require a joined up Government approach. To achieve this, there would be significant benefit in Government forming an Offshore Wind Development Committee on the model of the IFSC, where the Department of the Taoiseach plays a lead role. The Committee would bring together representatives of the relevant Departments and Agencies and industry representatives, with a remit to oversee the work necessary to develop the offshore wind industry.

KPMG

Appendices

Appendix 1

Glossary of terms

CEBR	Centre for Economics and Business Research
CfD	Contract for difference
CSR	Corporate social responsibility
EPC	Enduring policy connection
EU	European Union
FDI	Foreign direct investment
GDP	Gross domestic product
GDR	Greater Dublin Region
GVA	Gross value add
LCoE	Levelized cost of electricity
MW	Megawatt
NVQ	National vocational qualification
PSO	Public service obligation
PV	Photovoltaic
RE	Renewable energy
REFIT	Renewable energy feed-in tariff
RESS	Renewable energy support scheme
RO	Renewable obligation
ROC	Renewable Obligation Certificate
SDZ	Strategic development zone
SEAI	Sustainable Energy Authority of Ireland
SME	Small to medium enterprise

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