Offshore Wind – Phase Two Consultation

9th March 2022

ESB Generation & Trading

Contents

1. EXECUTIVE SUMMARY

ESB Generation and Trading (ESB GT) welcomes the opportunity to respond to the Offshore Wind Phase Two Consultation.

Ireland has committed to achieving net-zero emissions no later than 2050, and to deliver a 51% reduction in emissions by 2030 from a 2018 baseline. Renewable electricity will play a significant role in bringing these ambitions to fruition. The 2021 Climate Action Plan set out a target to provide up to 80% of demand through renewable generation by 2030. Offshore wind is anticipated to deliver a large proportion of this goal with the government committing to a target of at least 5GW of offshore wind by 2030 and a broader objective of at least 30GW in the longer term.

The management of Phase Two will determine how projects obtain seabed exclusivity (via Maritime Area Consents ("MAC")), the method of grid connection and the provision of a route to market through Offshore RESS ("ORESS") and other options. This response outlines the view of ESB GT in relation to each of these areas and is summarised as follows:

- The grid capacity identified in the EirGrid *Shaping our Electricity Future* report does not provide sufficient headroom to ensure that the 5GW target will be reached by 2030.This report must be updated to ensure that the additional capacity required to meet the target will be delivered. We believe that there is additional capacity available that can be utilised to provide the necessary headroom.
- A properly implemented Option B as outlined is the most viable of the four proposed Phase Two options but we emphasise our view that the optimum sequence of events is MAC award, consent, ORESS contract and grid connection agreement.
- Enabling hybrid connections should be progressed now as a matter of urgency. They are not only wholly consistent with Irish energy policy, but they are also clearly in the interests of Irish electricity customers as they accelerate the delivery of ORESS thereby reducing the risk of Ireland falling short on its 2030 targets while also facilitating greater use of existing network assets. They will also serve to substantially reduce the amount of new network assets required to accommodate the same volume of wind on a standalone basis. Consequently, this means that enabling hybrid connections will reduce the overall costs faced by customers, will reduce the buildability/planning risk faced by developers, will create the real prospect of accelerating Ireland's transition to a low carbon economy and will add to Ireland's security of supply by providing a source of firmer power (when compared to the standalone alternative) on the

electricity system. It is inconceivable that given the significant benefits arising from hybrids that Ireland would not embrace this opportunity.

- Considering the project attrition rate, which is to be expected, the overall target capacity for offshore wind must be increased to at least 7GW, if the 5 GW target is to be delivered. The inclusion of hybrid projects and other projects is essential in making this happen.
- Floating offshore wind must be accommodated within Phase Two to ensure that Ireland captures the many benefits such as supply chain development, job creation and facilitating whole energy systems. Therefore, as part, of increasing the overall target capacity from 5GW to at least 7GW by 2030, a sub target of at least 1GW of floating offshore wind should be set. Again, hybrid connections will also be key in meeting these targets.
- Ireland has a tremendous opportunity to develop a major indigenous energy storage capability and improve its long-term energy security. This will be achieved by scaling out floating offshore wind to produce green hydrogen at scale that can then be stored in sub-sea salt caverns and depleted gas fields – but only if action is taken now. This capability will be key in solving the issue of renewables intermittency, providing zero carbon dispatchable power and most critically will provide Ireland with significant energy security benefits at scale. The building blocks to deliver these solutions are available and can be materially advanced before 2030 with projects such as Green Atlantic at Moneypoint and others already in development with this purpose. It is crucial that both hybrids and floating offshore wind are enabled through Phase Two to deliver this critical route to energy security for Ireland.
- Phase Two needs to enable the development of innovative technologies such as energy storage and green hydrogen production so that the full potential of Irish waters can be captured post 2030. Additional MACs should be allocated to enable such innovation projects along with a suitable support to progress the respective technologies.

2. INTRODUCTION

2.1 Climate Action and role of Offshore Wind

Developing a strong and sustainable Irish offshore wind sector provides a rare opportunity for the State to deliver on a wide range of government policies, from delivering on carbon reduction ambitions, improved energy security, opportunity for export, to job and supply chain creation, and regional development.

Ireland's Climate Action Plan is largely hinged on the nation's ability to rapidly scale up renewable electricity generation, a considerable proportion of which will be offshore wind. This will take a strong concerted effort to streamline processes and align key policies, including the treatment of Phase Two projects, the focus of this consultation. The opportunity for further onshore wind development in Ireland is constrained as suitable sites are not in plentiful supply, leaving offshore wind as the remaining renewable generation technology of significant scale. As such, offshore wind will play a central role in realising Ireland's ambitions and delivering on the up to 80% RES-E target by 2030. This was clearly appreciated within Ireland's Climate Action Plan, where a target of at least 5 GW of offshore wind was set out.

2.2 The role of green hydrogen in Ireland's long-term energy security

In light of increasing energy prices and the invasion of Ukraine by Russia, the European Union is now stepping up measures to improve its energy security and reduce its dependency on gas imports. It is now time for Ireland to follow suit and implement a long-term energy strategy to help improve its energy security and reduce the nation's dependency on fossil fuels. The ability to produce and store green hydrogen at scale is not only essential in terms of delivering a net zero energy system for Ireland but would also be a game changer in terms of improving the nation's energy security.

Ireland has a tremendous opportunity to develop a major indigenous energy storage capability. This will be achieved by scaling out floating offshore wind to produce green hydrogen at scale that can then be stored in sub-sea salt caverns and depleted gas fields – but only if action is taken now. This capability will be key in solving the issue of renewables intermittency, providing zero carbon dispatchable power and most critically will provide Ireland with significant energy security benefits. The scale of the opportunity of this industry for Ireland should not be underestimated and could see Ireland reaching energy independence in the long term. A national hydrogen strategy should be developed as a matter of urgency to help unlock this potential.

Fundamentally, to drive Ireland's future hydrogen economy we need to deliver cheap green power at scale to produce the levels of hydrogen required. Maximising the vast renewable resources off the west and south coast of Ireland will be essential in delivering this future. Early development of supply chains for floating wind will be central to delivering cost effective green hydrogen over the coming decades. It's imperative that this technology is supported in Phase two offshore development through both the MAC allocation and through a specific pot within the O-RESS auction. This strategic action taken now will see the state reap the benefits for years to come and potentially in time allow Ireland to reach energy independence.

2.3 ESB's Offshore Wind Vision

We believe that the development of offshore wind at scale is key to tackling the climate emergency with the potential not only to meet national but growing international demand for clean power.

ESB GT is demonstrating its commitment to support this objective by developing the Oriel Wind farm Project and the nearby Clogherhead project off the coast of Co. Louth. Oriel is a designated "Relevant Project" which means that it will be eligible to compete in the ORESS1 auction. ESB GT is also progressing plans for at least six different offshore wind farms in Irish waters all around the coast, including floating offshore wind farms off the east, south and west coasts.

We also believe that we can deliver a greater ambition by utilising our existing grid connections and generating plants to further the aim of reducing emissions. This vision and capability can be facilitated through various market and regulatory changes to allow hybrid offshore connections to participate in the electricity market. Such an approach would drive greater competition and better use of existing infrastructure, both leading to the reduction of cost to the consumer.

ESB GT is developing both fixed and floating offshore wind farms, both of which we believe will play a role in delivering the urgent 2030 ORE target. The Programme for Government also set out a long-term plan to take advantage of a potential of at least 30GW of floating wind. It is expected the costs of floating and fixed offshore wind technologies will continue to converge. Given the strategic importance of floating offshore to Ireland, it is important to provide support to floating offshore now to not only contribute to the delivery of the 2030 targets, but also to grow supply chain confidence. This early support will help build momentum towards a major floating offshore wind industry which is required to deliver the ultimate net zero target.

ESB will transform Moneypoint in Co. Clare, a 915MW coal-fired power station, into a Green Energy Hub (Green Atlantic at Moneypoint) with an ambitious investment plan to deliver huge benefits to the region. Moneypoint will become a centre for the construction and assembly of floating wind turbines. A deep-water facility already exists at the site, making it an ideal staging ground for the construction of the wind farm. The development of Moneypoint will support the wider plans of Shannon-Foynes port and help make the Shannon Estuary a focal point for the offshore wind industry in Europe.

We welcome the urgency injected by the most recent Climate Action Plan to scale up this industry through the target to develop at least 5GW of offshore wind. We also welcome the commitment to proposals that are more long-term, and which could provide strong economic growth for Ireland.

2.4 Irish offshore wind - configured for success

Ireland's expansive seabed resource, particularly off the west coast, leaves plenty of scope to develop a thriving offshore wind sector to not only meet domestic energy needs but to also meet energy needs further afield. Our offshore wind potential can be harnessed to create green hydrogen, a clean fuel source which can be stored. The capability to create and store green hydrogen is a critical step in delivering a net zero society. The ability to produce and store hydrogen at a large scale will also bring significant energy security benefits to Ireland and reduce the state's dependency on imported fossil fuels. Long-term, provided this industry is given the right support to scale up, there is an opportunity for Ireland to ultimately achieve energy independence.

Demand for this clean fuel source is set to rise steeply over the next two decades as countries increase action to eliminate carbon from their energy sectors. This pivotal change paired with Ireland's vast renewable resources, positions Ireland very strongly in creating both a prosperous domestic and export green hydrogen industry. To seize this opportunity for the nation, it is critical that the development of the sector is supported correctly and that the right concerted actions are undertaken by the state to set up this sector for success. Action now and over the coming decade will be essential both in terms of meeting the 2030 targets but also to maximise the long-term potential of the sector.

The primary role for Phase One offshore wind is to take the first steps towards meeting the 2030 target but it will also kick start the offshore wind industry in Ireland. It is imperative that ORESS1 does not experience any further delays and that some certainty is given to the industry to allow adequate supply chain to develop in the market. It will also be the first opportunity to road test the new offshore planning regime. The sooner that Phase One projects can be processed, the sooner any teething issues can be identified and addressed. The early resolution of these type of issues married with a growing supply chain will allow for a far more successful Phase Two development.

In essence, the fundamentals of the industry should now be established when entering Phase Three of offshore development in Ireland. This period of offshore development will very much be on scaling and growing the industry and building on the steps taken in Phase Two to establish the sector. Entering this phase of development with a strong supply chain base will position Ireland well to compete internationally for the growing demand of green hydrogen. Securing a net zero energy system for Ireland also hinges heavily on the floating offshore wind sector. The ability to deliver this most economically is reliant on scaling out the industry to conjointly service both the domestic and export market. To supply a domestic demand of hydrogen to meet our net zero ambitions, internal analysis indicates that in the region of 12-15GW of floating offshore wind will be required. There is also the potential for at least another 15GW of floating offshore wind to be developed based on the Programme for Government target to supply the growing export market demand. The scale of the opportunity of this industry for Ireland should not be underestimated and could see Ireland reaching energy independence in the long term. A national hydrogen strategy should be developed as a matter of urgency to help unlock this potential. It is critical that the right supports are given to this industry now, and that a supply chain for floating wind is established so as not to miss out to other markets and allow Ireland to reap the rewards for many years to come.

2.5 Grid capacity to unlock renewable and climate targets

The number one priority in terms of increasing renewable penetration in Ireland is timely access to grid. The most efficient use and development of this critical infrastructure will be central to delivering Ireland's 2030 targets and setting Ireland on a net zero trajectory. Greater investment in this infrastructure is required along with new approaches to maximise its use to meet these ambitions. Ireland has been a world leader in renewable energy integration, but more can be done with the current infrastructure to unlock greater potential.

ESB GT has concerns over the approach taken in Eirgrid's *Shaping Our Electricity Future* (SOEF) study and the implications it will have on Ireland's ability to meet its 2030 renewable target, the cost borne by the consumer, and the level of carbon that can be avoided between now and 2030. The preclusion of floating offshore wind also sets back the sector several years and will greatly hamper the future growth of the sector as set out in the previous section.

The SOEF is not a complete assessment of the available capacity for offshore wind around the coast of Ireland. It is a single view on how a 70% renewable generation target could be met in terms of grid delivery. This constrained view of grid availability gives no room for flexibility and substantially increases risk of failure, cutting out all other scenarios in the event this view cannot be realised. The realisation of this singular scenario is heavily dependent on the delivery of a series of large-scale grid reinforcements. Based on the track record of delivering these types of projects in Ireland, it is unlikely that all these reinforcements will be completed within the 2030 timeframe. This greatly highlights the need for a more flexible approach to give the highest change of success in delivering the 2030 target. The assessment in its current form effectively gives no allowance for a plan B to meet our 2030 targets.

The approach taken also undermines the competitive nature of RESS by restricting offshore entry capacity to a limited number of areas despite capacity being readily available in other areas. The competitive tension between projects in renewable support auctions has been seen to drive down costs in many markets across Europe. The requirement of Phase Two projects to align with the SOEF will greatly reduce the number of projects that can compete at auction which in turn will lead to higher clearing prices and ultimately higher costs borne by the consumer.

The 5GW capacity could be connected at other locations around Ireland without driving any additional reinforcements than which are proposed in the SOEF. Many ‘electrically close’ nodes are available across the coast which require little to no further reinforcement which must be identified in a new iteration of the report which should be completed imminently to improve competition and reduced deliverability risk.

For instance, a large percentage of the 2.9GW proposed to connect into the Dublin area could also be connected to other “electrically close” nodes (for example Moneypoint and Louth) which also still feed the large demand in the Dublin Area. The availability of such nodes is particularly critical given that significant reinforcements are required to deliver 2.9GW into the Dublin area and there is a high probability that these will not be delivered by 2030.

The Dublin-centric strategy of the assessment also compounds planning risk by forcing developers to develop a large volume of offshore wind projects in a single area. This will greatly increase the cumulative impact of project development in this area and will make it even more challenging for projects to progress through an untested offshore planning regime. The next iteration of SOEF must be carried out immediately and include these “electrically close” nodes to help mitigate against these risks and thereby increase the likelihood of reaching the 2030 targets.

The SOEF report will already need to be updated to augment the 70% renewable generation target to 80% to bring in line with latest government policy. ESB recommends that the report is updated as soon as possible in 2022 to include all available grid capacity to allow all generating technologies to compete for a route to market in a non-discriminatory manner. This approach will allow developers to bring the best projects forward for support, enable competition and deliver the best value to consumers.

The exclusion of floating wind by Eirgrid from the report is not in line with industry thinking on the deliverability of this technology and will have serious ramifications on the growth of the sector in Ireland.

The recent Scotwind process coupled with the views of the supply chain (e.g. see letter of support from Vestas in the enclosed (see Annex 1) indicate that floating wind is very much deliverable by 2030. We are also aware that leading technology developers Ideol and Principle Power will also be responding to this consultation specifying that floating wind can be delivered by 2030. Eirgrid's decision to exclude this technology from the SOEF is a significant hurdle facing this technology in Ireland, and could see Ireland, miss important growth opportunities post 2030 to the benefit of other markets such as Scotland. Finally, and crucially the exclusion of floating offshore wind projects impedes the development of large-scale green hydrogen storage projects and the energy security benefits they bring to Ireland.

Planning permission is not expected to be a requirement to compete in either ORESS1 or ORESS2 auctions and projects that are successful at auction may still fail to secure planning. There are good examples of project attrition related to planning consent or planning decision delays in the past. In the UK, 10 projects totalling almost 12.5GW were expected to pre-qualify for the CfD Allocation Round 4 process for offshore wind projects. Actual qualification early in 2022 confirmed that only 7 of these projects, with an approximate capacity of 8.7GW, met the criteria. The 3 projects which did not qualify for Allocation Round 4 failed on planning grounds (30% attrition). In Ireland, an analysis of Strategic Infrastructure (large scale) onshore wind farm development has demonstrated that of 15 applications between 2013 and 2021, 6 were refused and another had its original approval overturned leading to a planning success rate of circa 53%. It is therefore very important that more than the 5GW target of grid is made available to allow for inevitable project attrition that will occur. One of the most effective ways of delivering the required additional capacity is through the facilitation of hybrid connections as set out in section 2.6 and Question 10. These connections would significantly increase the level of additional capacity available without any reliance on timely grid reinforcements. These connections will give greater flexibility for target delivery and greatly enhance ORESS competition and should therefore be included in the next iteration of the SOEF report.

Throughout this section, ESB GT has made several recommendations that would improve the approach taken by the SOEF and which would greatly increase the State's ability to deliver on its ambitious 2030 targets. It is imperative that these changes are made as soon as possible during 2022, to give clarity to the industry, to provide the most accurate assessment of all available capacity and to ensure non-discriminatory competition for offshore wind capacity regardless of whether the technology is fixed bottom or floating. ESB GT has consistently made representations to key stakeholders including DECC and CRU outlining the national benefits of utilising hybrids and this more flexible approach to grid planning will enable a far more successful Irish offshore sector.

2.6 Phase Two projects

ESB GT welcomes the efforts of DECC and others to devise a methodology to ensure that projects are identified and progressed in a manner conducive to the delivery of at least 5GW by 2030.

The consultation document proposes four options which might be used to progress the next phase of offshore wind projects. We believe that, of the four, Option B is the most suitable. Given the level of interest by the industry in developing new projects in Irish waters, it is crucial that the process to award MACs to applicants is transparent, fair and in the best interests of the State - Option B is the variant that performs best against those criteria.

A Deployment Security is proposed as a method to ensure the bona fides of the applicant under a number of the options. Given the high level of necessary development expenditure to the point of planning consent, combined with the potential expense of an annual development option fee or levy, we believe a project developer will be sufficiently incentivised to deliver capacity without the need for an additional performance security. It is also likely that a successful applicant will be required to meet various financial and technical requirements, which should also act to reserve MAC awarded for those best placed to deliver capacity in a timely manner. In addition, the imposition of a Deployment Security would impose additional burdens on both MARA and the developer for limited, if any, benefit. We do, however, agree that in order to further incentivise successful delivery of capacity, developers should lose their entitlement to MACs if they do not meet development milestones throughout the process, subject to an ongoing review mechanism.

Option B, by its very nature, is designed to be a competitive process and has the potential to deliver the best results for both the State and the developers. It is important that clear assessment criteria are identified and processed to ensure equitable allocation of MACs by MARA. ESB GT recommends that, as outlined in the MAP Act, assessment criteria should centre on items such as "fit and proper person" assessment, technical and financial capability, the "preparedness" of the developer and the site, the degree of innovation incorporated in the proposed project and a capped option fee. In addition to the list proposed, we believe that a determination or assessment by MARA of what is in the best public interest should feature in the allocation of MACs. We are not at this time proposing how the individual assessment criteria should be weighted but we would suggest that MARA consider the operation of similar competitions in other jurisdictions.

Notwithstanding the challenges associated with delivering any offshore wind projects, it will be securing a viable grid connection which will most likely finally determine the delivery of an operational project. Available grid connections are scarce, and care needs to be taken to ensure that the grid capacity is only allocated to projects that can deliver. As such, final allocation of grid capacity should be a function of ranking in the ORESS auction i.e. grid capacity at any given node should be allocated to the highest ranking ORESS project that has a grid connection assessment for that node. Any attempt to auction grid capacity separate to an ORESS auction runs the risk of ending up with misaligned results.

While recognising the need for Ireland to deliver at least 5GW of capacity by 2030, ESB GT does not believe it is in the best interests of the State to create a “cliff edge” transition pre and post 2030. Delivery of projects depends on a successful consent, a viable route to market and a timely grid connection. Delays to any or all of these are likely, and it would be unwise to revoke MAC awards in 2030 if potential projects have been delayed through no fault of their own.

The consultation document references the notion of reserve projects in the context of the options proposed. ESB GT believes that the idea of reserve projects is counterproductive. A reserve project would have to proceed with the development of a project on the understanding that it could only achieve a route to market if another project had tried and failed. Aside from the timing challenges that would arise in these circumstances, it is unreasonable to expect developers to continue to progress a reserve project at considerable expense with only a slim chance of it being a successful project.

2.7 Hybrid connections

ESB GT defines a hybrid grid connection as two or more generation units under the same connection agreement, with a combined installed capacity greater than the connection agreement MEC, dynamically sharing the MEC at the point of connection to the grid. The concept of a hybrid connection as defined is well understood internationally and there are numerous international examples whereby the complementary nature of two or more generation sources is used to the benefit of the overall electricity system. An objective of enabling hybrids has been included in the CAP for some time but progress has been slow. Action is required immediately to progress all hybrid technologies, including offshore hybrids, as outlined in Action 125 of the CAP Annex of Actions.

Enabling hybrid connections should be progressed now as a matter of urgency. They are not only wholly consistent with Irish energy policy, but they are also clearly in the interests of Irish electricity customers as, on the one hand, they accelerate the delivery of ORESS and thereby reduce the risk of Ireland falling short on its 2030 targets and, on the other hand, they facilitate greater use of existing network assets thereby reducing substantially the amount of new network assets required to accommodate the same volume of wind on a standalone basis. Consequently, this means that enabling hybrid connections will reduce the overall costs faced by customers, will reduce the buildability/planning risk faced by developers, will create the real prospect of accelerating Ireland’s transition to a low carbon and will add to Ireland’s security of supply by providing a source of firmer power (when compared to the standalone alternative) on the electricity system. It is simply inconceivable that given the significant benefits arising from hybrid that Ireland would not embrace this unmissable opportunity.

The benefits of hybrid connections are summarised as follows:

1. **Efficiency**. Two or more generators using the same infrastructure means more efficient use of that infrastructure. Furthermore, given that the infrastructure is already there, it provides additional generation capacity in a faster timeframe, thereby allowing Ireland to meet its offshore renewable generation targets more quickly and with less disruption.
2. **Sustainability**. Using existing grid infrastructure avoids the need to build new infrastructure. Avoiding new infrastructure has environmental benefits and reduces the use of physical resources. In addition, the ability to avoid the development of new infrastructure means that the project has a greater degree of social acceptance.
3. **Security of supply**. The movement to more renewable generation means that it is more difficult to balance the electricity demands of the consumer with the generation profile from renewables. In general terms, and for the medium term, conventional power stations will be needed to balance the generation supply when there is reduced output from wind. A connection combining an offshore wind farm with a conventional power station means that, in practical terms, that the combined facility can provide baseload generation by combining renewable and thermal generation.

From a technical perspective, connecting offshore wind projects to the system via a thermal power station will have no additional impacts on the system beyond what would occur if an offshore wind farm were connected to a similar location using a standalone connection. Currently, the provision to dynamically share the MEC between different units has not been established and limits the type of hybrids that can be utilised today. Only when units can dynamically share the connection can the full value of a hybrid connection be attained. Another barrier is the inability for multiple legal entities to connect behind the same connection. Contractual arrangements are currently between the TSO and one grid connection counterparty. The over-installation clause from current grid code should also be removed for these types of projects to allow the entity/entities to build assets to maximise the utilisation of the MEC. These barriers should be addressed by CRU, ESBN and EirGrid as soon as possible to unlock greater value from existing grid connections. There are some additional more minor regulatory changes required in relation to grid code, DS3, the Trading and Settlement Code and SEMO rules – further details on these changes are provided in our response to Question 10.

A query has been raised in the Phase Two consultation as to whether, if offshore wind hybrid connections are permitted to participate in the ORESS process, this would be incompatible with the

State Aid approval for the Renewable Energy Support Scheme (RESS) or more broadly, competition law. ESB GT has sought an external legal opinion on this issue (see Annex 2) (this is a confidential document so will not be published with the final response) and it has concluded that, on the contrary, exclusion of offshore hybrid wind connections could be a breach of the State Aid rules as ensuring the participation of such connections in any ORESS auction would increase the degree of competition and give rise to pro-competitive effects.

Given that a key principle underpinning the RESS state aid approval is that aid should be granted on the basis of clear, transparent, and non-discriminatory terms, and considering hybrid connections and associated projects can enhance competition, their inclusion in the auction is important from both a state aid and competition perspective.

Competition for hybrid connection points needs to be considered in the context of all hybrid connections and not just those applicable to offshore wind projects. Under the widest definition, any existing thermal or renewable generation station could form the basis of a hybrid connection with another technology, for example, an inland gas fired thermal station could link with an onshore windfarm or a solar project might decide to include a battery storage facility onsite. This is certainly what has been envisaged in the past by the System Operator Multiple Legal Entities consultation and is what is referenced in the CAP Action 125 – "*Determine contractual framework approach to accommodate Multiple Legal Entities behind a single connection point*." ESB GT believes that hybrid connection points should be considered in line with the developing policy applicable to all potential hybrid connections.

2.8 Enabling Floating Offshore Wind

The application of floating technology to offshore wind is still a relatively young industry. It provides an opportunity for early adopters of the technology to build a supply chain without the need to compete with more established markets. This was demonstrated in the onshore wind industry – there is a high correlation between the countries that were early to embrace the technology and those which have captured the lion's share of the supply chain in terms of turbine technology. Ireland has one of the highest proportions of onshore wind farms compared to the size of its overall electricity market and yet has not been able to capture any of the turbine supply chain given that it had already been established in other countries such as Denmark and Germany.

The value of the floating foundations for offshore wind is estimated to be approximately one third of the total project capital value. While in the short term it is likely that the turbine components will continue to be manufactured in mainland Europe, there are solid reasons as to why the floating foundations should be manufactured and/or assembled in Ireland. The business case for manufacturing foundations becomes even more compelling if they are built from concrete rather than steel. A report completed by BVG Associates on behalf of ESB (as included in the Annex 3) demonstrated that the construction and assembly of a 400MW floating offshore windfarm off the west coast that uses the existing Moneypoint power station site as the construction and assembly hub could create a total gross value added (GVA) of €934m to the Irish economy with over 7,000 employment years and almost 5,000 indirect employment years. Much of this spend and the majority of the jobs would be local i.e. in the Clare, Limerick and Kerry region.

There is a clear recognition that floating offshore wind off the west coast has the capacity to supply multiples of the current Irish electricity demand and therefore the long-term development of the industry cannot be based on a typical grid-connected solution alone. Alternative routes to market will be required for floating offshore wind and the manufacture and deployment of hydrogen is seen as an exciting opportunity in this regard. At a domestic level, hydrogen is seen as a key enabler to decarbonise the Irish economy. In the short term, heavy vehicles such as trucks and buses will be powered by hydrogen rather than batteries and in the medium term, hydrogen is being investigated as an alternative to natural gas when it comes to heat and power.

Aside from the domestic market, there is a growing demand for hydrogen (and hydrogen derivatives such as ammonia) in mainland Europe that is manufactured from renewable energy (so called green hydrogen) as opposed to hydrogen created from fossil fuels. The expected performance of floating offshore wind farms means that hydrogen manufactured in Ireland will be cost competitive with other global sources and that opens a real export market opportunity. There has already been exploratory engagement with the German authorities in this regard by a number of stakeholders.

Taking into account both domestic demand for hydrogen and the exciting export opportunities, the west coast is ideally based to be the hub of a hydrogen supply chain in the coming years. Development of this supply chain should commence now so as to position Ireland favourably to compete with locations such as the East Coast Scotland in developing an industry of scale.

Floating offshore wind is seen as key to unlocking the future potential of Irish territorial waters. It is important for both the industry and the government to prepare to capture that energy in this decade. Given international developments and the fact that floating offshore wind is no longer an embryonic technology (see Annex 1), ESB GT believes that it is crucial for provision to be made within Phase Two to set a target of at least 1GW of floating offshore wind by 2030. For reasons already discussed, it would not be feasible or advisable to try to accommodate this 1GW target within the existing 5GW target. ESB is therefore proposing that Phase Two design must incorporate a provision for a total cumulative capacity of 7GW including an additional 1GW of floating offshore wind projects. Hybrid connections will be a key enabler to these floating projects

2.9 Innovation

ESB GT believes that floating offshore wind is no longer an innovative technology and therefore believe that it should be managed separately as is outlined elsewhere in this response. This technology would be considered a mainstream technology as you can see from our letter of support from Vestas in Annex1. Leading technology developers Ideol and Principle Power will also be providing submissions to this consultation highlighting the maturity of this technology and it able to deliver by the 2030 target.

As regards innovative technologies that have not yet reached full commercial operation e.g. wave and tidal generation, hydrogen production, we support the proposal in the consultation document that special allowances be established for such technologies within Phase Two. Furthermore, given that these technologies will make a more significant contribution to post 2030 targets, we believe it is not essential that such projects reach commercial operation by 2030. Innovation technologies by their very nature are uncertain and it would be unreasonable to constrain development of such technology by arbitrary deadlines, but it is equally important to provide early support so that the technologies can reach commercial status as soon as possible in preparation for large scale deployment beyond 2030.

Zero carbon energy hubs demonstrations which combine offshore wind, large scale hydrogen production by electrolysis, hydrogen storage and zero carbon dispatchable power generations fuelled by renewable hydrogen should be supported under phase 2. These hubs represent a glimpse into energy sites of the future that will help secure Ireland's zero carbon energy system. These hubs should be in the order of 600MW of floating wind with at least 200MW of electrolysers included to produce hydrogen. The innovation aspect of these projects should not be limited to technologies used but include all innovative approaches (e.g. unit configuration, business models and trading between units) that can be harnessed to maximise the value of these hubs to the wider Irish energy system. These hubs should be given the flexibility to combine some of these technologies and different approaches to develop an innovation project for support. The development of these projects should also be supported and included in Ireland's National Hydrogen Strategy.

3. CONSULTATION QUESTIONS

3.1 Which is your preferred option and why of:

a) The above options?

Option B

b) The above options, variations of same, and other possible options within the parameters outlined in this paper, particularly sections 3 and 4?

We are of the view that Option B represents the only viable proposal. This option is more closely aligned with processes that have operated successfully in other jurisdictions, including the recently concluded Scotwind process. This proposed auction system, if supported by appropriately weighted criteria, will give confidence to DECC and to developers. Providing early visibility of the intended assessment criteria is a key measure. This will enable all prospective competing parties to plan effectively in relation to development activities and strategy and it will also help to generate transparency in the process.

The MAC award process must be progressed directly after MARA is established to give the projects the opportunity to carry out site survey work and other development work as early as possible in advance of the ORESS 2 auction, which will be important to enable higher quality bids.

In terms of reaching a target of at least 5GW of offshore wind, we believe that Option B provides scope to award sufficient MACs to allow the development of 7GW of projects. This will require additional grid capacity as referenced elsewhere in this response as well as additional ORESS auction awards. None of the options proposed by the consultation paper make real provision for project attrition. As already set out in section 2.4, experience in both the UK and Ireland has indicated that attrition along the development pathway, particularly in relation to planning consent, is a real feature of project delivery. In the recent CfD Allocation Round 4 process in the UK for offshore wind projects, only 7 of 10 expected projects qualified for process due to planning challenges faced by three of the projects. Similarly, in relation to Strategic Infrastructure Development (onshore wind) in Ireland over the past decade, only 8 of a total of 15 large scale wind farms made it unscathed through the planning process.

We have significant concerns in relation to the workability of each of the alternative options. The proposal outlined in Option A is considered unreasonable as some of the main risks to delivering a project by 2030 are outside the control of the developer and it would not be proportionate to draw down a deployment security in these circumstances. In addition, it appears that MACs would potentially be awarded on a first come, first serve basis and this kind of solution will never deliver the best outcome.

Options C and D are not considered to be workable as it not appropriate to use the ORESS auction as a means of choosing winners at such an early stage of the development process. These options are more consistent with a plan-led approach where detailed survey work is available to underpin the evaluation of all potential development sites.

3.2 Option A proposes that a deployment security is required for to apply for a MAC in Phase Two.

ESB GT understands the desire of DECC to ensure that applications for MACs are made for projects that have the best pre-2030 deliverability prospects. We do not, however, believe that a Deployment Security is a suitable instrument to achieve this objective given the practical difficulties/ funding cost in placing such a security with a number of project development risks still outstanding. Considering development costs and an assumed Development Stage Levy, the cost of developing an offshore wind farm to the point of planning consent is likely to be €60m-€90m. This is a significant amount and not one that would be written off lightly. Given a combination of a significant amount of committed expenditure and the initial filter of various financial and technical qualification criteria, we believe there is sufficient alignment of interest to bring about delivery of capacity in line with the stated targets and timelines.

a) How should the security be calculated and what rate should apply? If the security was to be calculated on the basis of planned capacity, what rate should apply?

We are conscious of (and fully support) the setting of at least a 5GW target for deployment of offshore wind capacity by 2030. However, on receipt of a MAC a project developer is still exposed to a number of risks attached to delivery of an offshore wind farm. A project developer will still need to go through an untested planning permission approval process, will not yet have received an indication of grid connection cost and will still need to complete a significant amount of further development and analysis before they can robustly assess the likely competitiveness of their project in an ORESS auction. Given this level of risk outstanding on MAC award we do not believe the project developer should be exposed to a cost for non-delivery. Such a security structure may be more appropriate at the time of ORESS contract award, possibly mirroring the structure of the Performance Bond under the RESS regime whereby the security would be drawn down if Commercial Operation Date is not achieved by a certain date. With regard to a disincentive for projects with possible delivery post 2030, we believe the features set out in the "Advantages" section of Option A, combined with the scale of development expenditure already incurred and lack of a likely alternative route to market outside of ORESS 2 are sufficient to discourage project developers from applying for a MAC unless they are comfortable (based on the variables they can control) that their project can reach commercial operations by 2030. Certainly, we would not view a Deployment Security in combination with a Development Stage Levy as being appropriate. Should any security be required this should be constructed so as to cover variables that are reasonably within the control of the project developer, such as payment of levies or proper maintenance and protection of the seabed area covered by the MAC.

b) Should the security be required to be in place prior to application for a MAC or post-issuing of a MAC? If post-issuing, what is a reasonable timeframe?

We are clear in our view that the imposition of deployment securities in relation to the award of MACs is inappropriate for the reasons set out above. The payment of an annual development levy is a proven structure and one which places sufficient incentive on a developer to commit investment and resources in the project.

c) Under what terms should this security be drawn down?

We do not support the use of a deployment security

d) The security, as proposed, expires with the securing by a project of a route to market. For projects successful at ORESS 2, this is also the stage when the auction performance security is due be put in place. Would it beneficial for the deployment security to be rolled over towards the RESS performance security? How best this be managed?

The security as proposed (i.e. implying a delivery obligation) would be difficult to put in place as funders (e.g. in the case of a Letter of Credit) would be asked at the time of MAC award to take a risk on a project delivering capacity by a certain date. Given the risks outstanding at this time it is likely that the cost of any security that may be put in place would be quite high, which would have to be factored into the bid of that project in a ORESS auction. This is quite a different proposition to the Performance Security currently required under the RESS regime whereby the only substantive risk outstanding on the signing of the Implementation Agreement is construction risk, which is largely well understood in the context of onshore wind and solar energy projects.

e) What other terms should apply to this security?

We do not support the use of a deployment security

3.3 Option B proposes a competitive MAC process.

a) What assessment criteria should be used in this process? What should the weighting of this criteria be?

As noted in the response to Question 1, the proposal set out in option B is the most favourable, subject to certain amendments being made. The challenging delivery timeframe to 2030 means that the allocation of Phase Two MACs can only be achieved through the implementation of a robust and efficient process with a focus on prioritising those projects which have materially progressed a programme of development work. In broad terms we support both the criteria set out under Option B in the consultation paper and those established under Schedule 5 of the MAP Act.

The chosen MAC award process for Phase Two projects must enable the allocation of sufficient capacity to meet the overall 2030 target, allowing for attrition and required competition levels in the ORESS 2 auction. We need to commission more than 5GW to ensure that we actually achieve 5 GW gigawatts given the well documented challenges that all players face in developing infrastructure in Ireland.

For these reasons, we firmly believe that at least 7 GW be procured through the first two offshore RESS auctions. This will need to include at least 1 GW of floating offshore wind. Procuring additional capacity also gives confidence to the vital supply chain and will bring greater certainty towards delivering the PfG targets.

The proposed criteria for the competitive MAC process are set out below.

Criteria	Competitive MAC Assessment
Consistency with the National Marine Planning Framework	Pass/Fail
Consistency with EirGrid's latest plans, e.g. Shaping Our Electricity Future	Pass/Fail
Financial Capability	Pass/Fail
Fit and Proper Person	Pass/Fail
Technical capability	Weighted
Site Investigation works or other preparatory undertaken, including stakeholder engagement	Weighted – development progression to be scored in the context of ability to deliver for 2030
An auction for the seabed levies to be paid by MAC holders	fixed development levy applied - in line with Phase One MAC development criteria
Efficient use of grid (less need for new infrastructure and making better use of current system)	Weighted
Whether the proposal is in the public interest[1]	Weighted
Innovation[2]	Weighted

[1] Any sustainability, electricity system operational advantage, equality or inclusivity practices that are currently in place, and demonstrate how they will incorporate these principles throughout the lifetime of the MAC.

2 Any novel and innovative measures undertaken which lead to a reduced risk, reduction in programme delivery timeline or addresses specific challenges of delivering ORE projects in Ireland.

b) Should a seabed levy auction be included in this assessment? What weighting should the auction result have?

Our strong preference is for a fixed seabed development levy to be included as part of the Phase Two MAC Competitive process. It is important that projects are on a level playing field in relation to levies paid as part of a MAC process as Phase One and Phase Two projects will most likely be competing in ORESS 2.

c) Should a deployment bond be maintained under this option? Why, or why not?

As per our answers to Question 2, we do not believe a Deployment Security is appropriate given the outstanding risks to delivery at the time of MAC award. The purpose of the deployment bond as set out within the consultation document is to discourage speculative bidding for projects which do not have a credible programme for 2030 delivery. Deployment securities are proposed as a method to ensure the bona fides of the applicant under a number of the options. ESB GT believes that, with the use of an appropriate development option fee, the case for an additional development security is not justified and, in addition, would impose additional burdens on both MARA and the developer for limited, if any, benefit.

3.4 All of the above options assume that Phase One projects retain their MACs for Phase Two.

a) Is this the correct approach? Why?

We support the retention of MACs for Phase One projects to ensure that any project which did not clear within the ORESS1 auction can continue through the planning consent process. Failure to secure a winning bid within ORESS1 does not necessarily mean that the project is immature or financially unviable, but simply that another project bid lower. Requiring unsuccessful projects to reapply for a MAC would undermine investor confidence, increase the pressure on scarce MARA resources and decrease the attractiveness of the Irish offshore market. To ensure a level playing field it is critical that Phase One projects should be subject to the same terms and conditions as Phase Two projects.

b) Would requiring Phase One projects that are unsuccessful in securing a route to market, within a specified timeframe, to re-apply for MACs result in a better outcome for the sector, the State and consumers? Why?

As noted in the response to the question above, we do not agree that requiring Phase One projects that are unsuccessful in securing a route to market to reapply for a MAC would provide a better outcome for any of the main stakeholders involved. This is because it would unnecessarily increase developer costs, add extra risk and uncertainty which serve only to increase bid prices, without any providing any additional benefit. In addition, it would increase the demand for resources within MARA, which is an undesirable outcome given the priority associated with awarding Phase Two MACs.

c) If Option D was selected would this require unsuccessful Phase One projects to relinquish their MAC before ORESS 2? If so, should these projects be given any preference such as a right of first refusal if they match a winning bidder's terms for their MAC area?

Option D is unworkable and should not be progressed, so we have nothing more to add in relation to this question.

3.5 To incentivise swift deployment, discourage speculative hoarding of the marine space, discourage MAC applications by projects incapable of delivering by 2030, and facilitate the coherent transition to a plan-led Enduring Regime, it is proposed that all MACs awarded in Phase One and Phase Two will expire prior to the Enduring Regime, should the holders of these consents be unsuccessful in securing a route to market.

a) Is this the correct approach? Why?

The transition to the Enduring Regime is a fundamental aspect of the overall design and a proportionate approach to the treatment of projects endeavouring to reach COD by 2030 is required. We recognise the difficulties associated with planning for the Enduring Regime when there is a level of uncertainty around project delivery by 2030. However, considering the major investment demanded in the development phase, a project which successfully secures an ORESS contract must have certainty that the MAC will remain in place sufficiently long to enable energisation. If there is a risk that the MAC could be lost in an abrupt transition to the Enduring Regime then it would not be possible to successfully finance the project in the first instance. Clearly, there are risks outside the control of the developer such as legal challenges to planning consent which may result in a project not being able to deliver for 2030. This is a very real scenario, and it is only reasonable that a developer should have a time extension beyond 2030 to enable project completion if these circumstances arise. A very clear distinction must be drawn however, between a developer undertaking every reasonable measure to ensure that a project is completed by 2030 and one is who is not committing the appropriate level of resources or financial investment to ensure project realisation. In the latter scenario, MARA must be able to terminate the MAC. Considering the foregoing, we propose that the MAC has a default period of 10 years to cover the development phase with opportunity to extend this as appropriate where the developer can demonstrate legitimate reasons for delay. We believe that this proposal fairly addresses both the interests and concerns of the State and the developer.

b) Would this approach incentivise deployment and/or discourage hoarding of the maritime space?

We suggest that, in order to demonstrate their commitment to projects, developers should lose their entitlement to MACs if they do not meet development milestones throughout the process, subject to an ongoing review mechanism. Our preference is to allow for sufficient flexibility within the system so that projects can proceed with confidence through the development process. While hoarding of valuable maritime space is clearly something which needs to be avoided, there is careful balance to be struck between penalising developers who haven't committed the appropriate level of funding and resources to a project and imposing onerous completion conditions on genuine market participants. It is critical that projects which have secured a clear route to market, but which may have experienced delays outside of their control, due to for instance access to grid or judicial review, should have options to extend their MAC development period and be permitted to proceed into the early 2030s.

c) Would this approach discourage MAC applications in Phase Two from projects with poor pre-2030 deliverability?

This approach is unlikely to discourage MAC applications in Phase Two from projects with poor pre-2030 deliverability. Developers by their nature will take an optimistic approach to project delivery and the proposal to terminate the MAC prior to the Enduring Regime may not achieve the desired outcome. It is important therefore that the capacity of a developer to deliver a project by 2030 should be a key consideration for MARA in determining a MAC application and that there is a series of milestones which the developer has to meet on an ongoing basis in order to retain a MAC.

3.6 What are your views on providing provisional grid offers to projects in the case where all projects receiving such an offer will not be able to obtain a full grid offer?

a) How can and should the award of full grid offers be tied to the auction results?

Projects will only have a reasonable degree of certainty of delivery if they hold access rights to the seabed, consent and a route to market. We believe that the best positioned project in any ORESS auction should obtain a full grid connection offer at any given node. This will mean that projects lower in the overall ORESS merit order will proceed in preference to projects higher up the merit order but ultimately grid capacity is a scare resource and therefore it should be the best performing project at any given node that should be given a full grid offer.

b) Should allowance be made for projects that do not effectively compete in the auction but share a preliminary connection offer with projects that do to remain eligible for a CPPA route to market?

We do not support this approach as grid capacity is limited. The available grid capacity will have already been awarded. A CPPA could be considered in the event that an awarded project at a given node failed to secure planning.

3.7 What are your views on auctioning capacity at particular grid nodes or regions in ORESS 2?

a) How should this operate? Should successful projects be required to submit ORESS 2 offers that clear both the overall auction and the auction for a given grid node or region?

ESB GT believes that there is no need to auction grid capacity at individual nodes or regions as per our answer to Question 6.

b) Should any nodes or regions be reserved for non-ORESS routes to market?

No, grid capacity is in short supply. No sense in sterilising a node for a route to market that is very immature in the Irish market.

3.8 In order to utilise grid capacity realisable by 2030 in totality, most options require the award of greater capacity in ORESS 2 than is realisable by 2030, and establishing reserve projects on grid orders of merit, possibly grid region.

a) What are your views on grid orders of merit? How best could reserve lists be established in a robust manner that does not give rise to legitimate expectations by reserve projects?

ESB GT believes that it would be unwise to offer ORESS contracts that exceed the grid connection capacity in any given region or at any given node. As an example, if two projects proposing to connect at a given node (each using the full capacity at that node) are both awarded ORESS contracts there is no other way to separate them other than by ORESS bid. In that circumstance, it would be unlikely that the project that came second in the ORESS auction would continue to develop given the reduced likelihood of the project reaching Final Investment Decision (FID). The only way not to give rise to legitimate expectations is to award an ORESS contract to the highest ranked project in the ORESS auction and to provide a full grid connection offer to that project.

b) How should grid orders of merit be established? Is using ORESS 2 bidding order, possibly by grid node/region, an appropriate methodology?

ORESS2 bidding order matched to the availability of grid capacity at any particular node should be used to award full grid capacity.

c) What obligations should be placed on reserve projects and what, if any, compensation should be provided?

ESB GT believes that the concept of reserve projects is not workable due to a combination of developer risk and project timelines. The only way a reserve project would consider the continuation of development would be if its development costs were to be underwritten. This would cost tens of millions for every individual reserve project contract.

d) How should reserve projects be serviced so that they can readily progress if required?

Aside from the costs involved, reserve projects would have to be managed in exactly the same way as the successful projects if they are to have any hope of meeting the target timelines.

e) How should reserve projects be held to the terms of their ORESS 2 offer

If reserve projects are processed in the same way as successful projects and if their costs are underwritten, then it should be possible for them to meet the terms of their ORESS 2 offer.

3.9 Option D outlines an auction with mutually exclusive offers and multiple bidders specifying the same MAC area and/or connection point allowing multiple bidders to specify the same MAC area and/or grid node/region and using ORESS 2 results to allocate the MAC area and/or grid node/region capacity.

a) What are your views on the feasibility of this option? What are your views on the feasibility of solving the auction using an optimisation approach?

ESB GT does not believe that this option is feasible due to the overheads imposed on both projects and officials to achieve successful outcomes. Such a process is not conducive to early deployment of offshore wind projects.

3.10 Hybrid grid connections are defined in this paper as single grid connections which facilitate the connection of both an existing or proposed thermal generation plant and a proposed offshore wind project.

We do not believe there is a requirement to have a separate definition for hybrid grid connection between a thermal generation plant and a proposed offshore wind project. There has been much work previously carried out in both Ireland and other international markets to explore the concept of hybrid units, hybrid sites and hybrid connections and this work does not differentiate between the technologies that form a hybrid grid connection when determining the applicable policy. Hybrid connections of all types of generation should be treated in the same manner.

ESB GT recommends the following definition should be adopted for hybrid grid connection. *A hybrid grid connection should be defined as two or more generation units under the same connection agreement, with a combined installed capacity greater than the connection agreement MEC, dynamically sharing the MEC at the point of connection to the grid.*

a) Do you support the facilitation of such connections, as defined? Why?

We support the facilitation of such connections along with the facilitation of all hybrid connections as defined above within the broader definition provided. The facilitation of hybrids has been a clear policy objective for some time that has been included in the CAP annex of actions but progress to date has been slow. Action is required to enable all hybrids, including offshore hybrids and to ensure that all regulatory hurdles are removed to allow these projects to progress.

These hybrid grid connections provide a range of benefits as set out below:

a) **Additional capacity**. The current version of EirGrid's Shaping our Electricity Future document indicates that by 2030, there will be 5GW of grid capacity available to connect offshore wind generation. This grid capacity is subject to many grid reinforcements and new build projects – any associated delay could mean that this capacity is not available by 2030. Furthermore, it is not certain that this capacity will be located in the right regions – almost 3GW of grid capacity for offshore wind is planned for connection in the wider Dublin region and it assumes there will be sufficient projects with both consent and access to a route to market to avail of this connection capacity. Hybrid connection capacity is available now and has the further advantage of being dispersed around the Irish coastline at strategic locations. In the best-case scenario whereby all the grid upgrades have been completed and sufficient projects are ready to connect, hybrid connections will still mean that more projects can be developed.

b) **Timely development**. The infrastructure development and upgrade needed to facilitate "at least 5GW" of offshore wind by 2030 (Climate Action Plan 2021) will be a significant challenge to those responsible. The necessary infrastructure to connect and dispatch new generation connected to existing thermal stations grid connection is already in place given the requirement for the System Operator to currently dispatch the full MEC of the existing thermal generators. As such, any generation behind a hybrid grid connection could be dispatched as soon as it is operational without having to wait for the necessary grid upgrades.

c) **Increased competition**. A key plank of the current Renewable Energy Support Scheme (RESS) is to promote competition between projects to achieve the lowest cost to the consumer. The increased grid capacity afforded by hybrid connections will allow a greater number of projects to compete in the forthcoming RESS auctions which in turn will make those auctions more competitive.

d) **Efficient use of existing resources**. Given the diverse nature of generation sources in Ireland and elsewhere, it is common for both thermal and renewable generators to have relatively low-capacity factors, either due to the nature of the generation source e.g. variability or to the dispatch rules that apply in any given system. Assuming that there is careful choice of the technologies behind any hybrid connection, it is possible to significantly increase the overall utilisation of the grid connection asset with an associated increase in the efficiency of the connection asset.

e) **Security of supply**. The movement to more renewable generation means that it is more difficult to balance the electricity demands of the consumer with the generation profile from renewables. In general terms, and for the medium term, conventional power stations will be needed to balance the generation supply when there is reduced output from wind. A connection combining an offshore wind farm with a conventional power station means that, in practical terms, that the combined output can provide baseload generation by combining renewable and thermal generation as necessary.

f) **Sustainability**. Making more efficient use of existing assets will always be more sustainable than building new assets to provide the same service.

g) **Social acceptance**. It is clear from experience in Ireland in recent years that communities are generally resistant to the development of new grid infrastructure and, in particular, the introduction of new high voltage overhead lines. Any initiative which can reduce the requirement for new infrastructure development is likely to welcomed by those particularly affected by such developments e.g. local communities, farmers and landowners and environmental lobby groups.

h) **Enabling floating offshore wind**. It is widely recognised that floating offshore wind will make a key contribution to Ireland's energy future. Recent evidence from Scotland demonstrates that floating offshore wind is a maturing technology ready to be deployed at scale in the current decade. More than half of the development rights to 25GW of offshore wind awarded by Crown Estate Scotland are for floating technology. In Ireland, hybrid grid connections are well located to facilitate the rapid deployment of floating offshore wind in addition to the fixed bottom offshore wind projects which will still make the largest contribution to the 2030 target.

However, action is required to enable all hybrids, including offshore hybrids and to ensure that all regulatory hurdles are removed to allow these projects to progress. Regulatory changes take time to implement. It is critical that these hurdles are prioritised and addressed over the coming 12 months to ensure that hybrid connections can be utilised and play their role in helping the delivery of the 2030 targets.

The primary regulatory hurdles that must be given immediate attention to enable these connections are:

- Allow dynamic sharing of MEC between units behind a single connection point
- Multiple legal entities behind a connection point
- The cap on over installation at connection of 120%

Currently, provision have not yet been made to enable the dynamically sharing of MEC between different units which limits the type of hybrids that can be utilised today. Only when units can dynamically share the connection can the full value of a hybrid connection be attained. Another barrier is the inability for multiple legal entities to connect behind the same connection. Contractual arrangements are currently between the TSO and one grid connection counterparty. The over installation clause from current grid code should also be removed for these types of projects to allow the entity/entities to build assets to maximise the utilisation of the MEC. These barriers must be addressed by CRU, ESBN and EirGrid as soon as possible to unlock greater value from existing grid connections.

Other regulatory changes that will likely need to be implemented to facilitate hybrid connection are:

- **Grid Code**. Further Grid Code changes may be required. Some areas that need to be considered are the communication challenges of energy/capacity available and scheduling of the energy within the power system constraints. The submission of COD and TOD by the units may also need to change depending on the setup of the hybrid connection agreement.

- **DS3**. There are a number of issues that will need to be addressed such as communication challenges of services available and scheduling of the services. There may also be potential changes to the tendering and qualification of services, and finally, the settlement of the services between the hybrid assets. These areas will also need to be addressed for the hybrid projects that are currently allowed for under the RESS2 T&Cs.
- **Trading and Settlement Code**. As the units under a hybrid connection are envisaged to be two standalone assets dynamically sharing the MEC, the impact on the T&SC may be limited. Some items to consider could be the registration of the assets as well as the settlement that is required. In instances where hybrid connection assets have participated in the CRM (acknowledging that a RESS asset cannot win a CRM contract) the settlement of difference and non-performance charges may also need to be reviewed.
- **SEMOpx Rules**. Similar to the T&SC, as these are individual assets it isn't envisaged that there should be any changes to the SEMOpx rules due to hybrids. However, REMIT does need to be reflected upon how the hybrid assets will participate in the ex-ante markets.
- **Capacity Market Code**. The CMC already allows for combining/aggregating units so the same methodology could be applied to the hybrid connections. The treatment of the de-rating methodology, qualification, volumes available to be submitted into the auction, and demand curve adjustments would need to be considered for a hybrid connection.

b) Are you aware of any other jurisdictions where such connections are permitted? Describe how hybrid connections are treated from a technical and regulatory perspective in these jurisdictions.

We are not aware of other jurisdictions that have facilitated the connection of both an existing or proposed thermal generation plant and a proposed offshore wind project. This is perhaps unsurprising as the Irish system has been at the forefront of developing solutions to integrating higher levels of renewable penetration given that it is a relatively small electricity system with limited interconnection. These connections are simply the next step in allowing better integration of renewable generation on the system.

Hybrid grid connections in a broader sense e.g., co-located renewable energy sources and/or battery storage sharing a single grid connection, are operational and under development in several jurisdictions such as GB, Netherlands, USA, India & Australia. Examples include the following;

Project	Details	Further information
Parc Cynog Solar and Wind Farm, Wales	In 2016 Vattenfall added 4.94MW of Solar PV capacity to its existing 3.6MW wind farm at Parc Cynog (operational since 2001). The solar and wind elements are connected to the distribution system via the same substation and grid connection and their output is managed by Vattenfall via a hybrid power plant control system.	Parc Cynog solar farm (dnv.com) Updated: Vattenfall praises good performance of co-located wind and solar energy park | Solar Power Portal Microsoft Word - HPPW_Crete_2019_WE_last version.docx (hybridpowersystems.org)
Haringvliet Energy Park, The Netherlands	Construction of Vattenfall's hybrid energy park was completed in 2021 and commissioning is due to be completed in early 2022. The hybrid plant consists of 21MW of wind, 41MW of solar and 12MW of battery storage. The plant features a Hybrid Power Plant Controller (HyPPC) which coordinates the different sub-plants, managing technical and market/economic objectives while monitoring and securing the grid connection's technical limitations and grid code compliance.	Hybrid power plants: two is better than one | en:former (en-former.com) https://youtu.be/Jiuzw-5NUAQ
Port Augusta Renewable Energy Park, South Australia	The Port Augusta Renewable Energy Park (PAREP) is a 317MW hybrid renewable energy project located in Port Augusta city, Australia. The site consists of 210MW of wind generation capacity and 107MW of solar PV and upon commissioning will be the largest wind-solar hybrid project in Australia. A new 275kV substation and export cable will connect the project into the South Australian transmission network. The project is being developed by Iberdrola and DP Energy, and is expected to enter commercial operation in April 2022.	Homepage • Port Augusta Renewable Energy Park (parep.com.au) Port Augusta project - Iberdrola RXHK :: Port Augusta Renewable Energy Project STATCOMs Contract Award *this piece contains some useful references to the control system and compliance with local grid code.

In September 2021 National Grid ESO in GB published its Guidance Notes for Co-Location of Different Technologies, wherein it describes how the grid code compliance process applies to various configurations of co-location installations of different technologies for the assistance of prospective customers planning connected their projects directly to the National Electricity Transmission System.

The guidance notes describe two distinct categories of co-located sites: supplementary (components are not independently controlled) and independently operated (the operation of different technology units is independent from each other).

c) Are there potentially unintended consequences associated with permitting hybrid grid connections, such as potential impact on grid system services provided by the associated thermal plant or potential impacts on the reliability of the thermal plant?

From a technical perspective, connecting offshore wind projects to the system via a thermal power station should have no impacts on the system beyond what would occur if an offshore wind farm was connected to a similar location using a standalone connection. In other words, the technical implications are driven by locational issues rather than use of hybrid/non hybrid methodologies.

The offshore connection at the thermal plant should have no implications for the reliability of the thermal plant in its own right. In actual fact, the combination of the thermal and offshore wind assets would increase the availability of generation at that point given that, should the thermal plant trip off for some unrelated reason, there is a high chance that the wind would have at least some generation and therefore not all of the generation at the location would be lost. The combination of offshore and thermal generation could also enhance black start capabilities with the offshore wind farm often being in a position to energise the thermal station in the event of a total system shutdown.

It is difficult to envisage the nature of the system services provision by 2030 given the predicted fundamental change in the overall system. The services required in 2030 and who will be in the market to provide them is still to be decided and heavily dependent on the SEMC's System Services Future Arrangements. The latest publication from the TSOs identified the potential volumes that will be available and could be required in 2030. It is forecasted that the primary role of gas turbines for example will be in Replacement Reserve (De-Synchronised) (RRD) and ramping products. If this is the case, there would appear to be limited impact of hybrid connections on the provision of system services as the thermal asset in a hybrid connection will be able to provide RM1, RM3 and RM8 (ramping products) when the wind asset isn't forecasted to generate. However, the ability of the thermal asset to provide RRD will be dependent on the output of the wind generator. Additionally, if the thermal asset was required to be on load it could be brought to minimum generation through the Balancing Market or through the Future System Service Arrangements (once it was designed to create efficient signals to market participants) and the wind generator would be traded/dispatched accordingly.

In terms of the capacity market, it is envisaged that hybrid connections would be treated in the same manner that combined candidate units are currently treated in the CRM i.e. they can be combined as per their individual de-ratings.

d) should proposed projects with hybrid connections be treated so as not to distort competition or afford undue competitive advantage to the incumbent owners and operators of the associated thermal generators?

Offshore hybrid connections do not distort competition but rather opens the use of additional grid capacity to allow a greater number of projects to be eligible to enter the auction. These projects would still need to be connected offshore but would simply connect in behind these thermal connections onshore rather than the grid nodes identified the SOEF.

It should also be noted that both the thermal and the offshore wind farm would be hindered by the nature of the connection. In the case of the thermal plant, it is possible that it could lose system service or capacity market revenue as a consequence of making space for the offshore wind project. Similarly, given that the TSO could use the thermal project in the balancing market, the offshore wind project is likely to suffer more dispatch down as a consequence of system services requirements than an offshore wind farm with a standalone connection would. These are factors that would also have to be considered when formulating a bid in the auction and would not be considered competitively advantageous.

ESB GT has completed an internal legal review as well as commissioning an external legal view of potential impacts on the RESS State Aid approval. The opinion from our external legal advisors, McCann Fitzgerald, is included as Annex 2 (this is a confidential document so will not be published with the final response) in this response. The fundamental principle guiding the European Commission's Ireland RESS State aid Approval is that open, competitive auctions should take place (in particular, as regards guaranteeing both the proportionality and the incentive effect of RESS aid Review of State Aid assessment). The facilitation of hybrid grid connections should increase the competitiveness of the RESS auctions given that it would increase the number of participants in the auctions and it would be reasonable to expect winning bids to decrease.

Excluding projects with a hybrid grid connection would be inconsistent with state aid rules. The European Commission's own rules on support schemes set out that they should be "non-discriminatory", "transparent" and "open to all generators". The current RESS approval specifically addresses exceptions to these rules as they apply to Phase One projects but does not specify the exclusion of hybrid connections in the opposite context.

McCann Fitzgerald also considered whether there was any competition law issue with hybrids and they concluded that hybrid project participation in ORESS2 would not violate applicable competition law and that full and fair participation of hybrid projects would be consistent with State obligations to conduct the auction on open, fair and non-discriminatory terms.

ESB GT commissioned Frontier Economics (FE) to complete a Regulatory Impact Assessment should offshore wind hybrid connections be facilitated. The full assessment is provided as in Annex 4 of this response but attention is drawn here to their assessment of competition impacts. Competition was considered from two perspectives – the ORESS auctions and the operation of the electricity market. FE concluded that hybrid connections would have no weakening or distorting of competition re relation to the ORESS auctions.

To ensure a complete review, FE also considered whether from an economic perspective there were potential competition impacts in the renewable generation sector, namely whether by allowing hybrid connections, incumbent thermal generators could establish a significant market share in renewable generation and therefore exercise market power. This concern was rejected for a number of reasons – firstly, the fixed price associated with any ORESS contract would not provide any incentive to a thermal generator to try to influence the wholesale market price. Secondly, a generator would have no incentive to curtail wind production to try to increase thermal price as any such attempt at market manipulation is covered by exiting regulation and the market is monitored to check for such attempts.

Beyond the lack of incentives to increase the wholesale price, generators face regulatory constraints which prevent the abuse of market power. In particular, the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT)14 addresses market abuse and transparency in the wholesale energy market. In its market abuse provisions, REMIT specifically prohibits market manipulation. The Agency for the Cooperation of Energy Regulators (ACER) has published detailed guidance on the application of REMIT, including specific examples of what constitutes market manipulation in the energy market. Among other things, this regulation specifies that the following types of capacity withholding are prohibited:

- economic withholding, or the offering of available generation capacity at prices above the market price that are not cost reflective, resulting in the asset not being dispatched; and
- physical withholding, such that available generation capacity is not offered at any price.

REMIT also requires market participants to publish key information about generation plant, including information on outages and closures. This creates a high degree of transparency in the market, such that any attempts at withholding wind generation would be even more obvious.

To ensure that the regulation is adhered to, the SEM Committee has a specific market monitoring unit to ensure compliance with REMIT. Therefore, it is unlikely that an offshore wind generator would exercise market power and impact the wholesale market price, as such behaviour would be observed and punished.

e) Do you support the facilitation of such connections, if the definition was adjusted to, e.g., an existing or proposed onshore battery, solar or other generator?

As set out in the response to the start of this question, we believe all hybrid connections should be treated in the same manner irrespective of the technology used. For onshore assets, these types of connection are currently facilitated through connection optimisation provided for under ECP (combination, hybrid, technology change and capacity relocation). It would appear discriminatory to adopt a different approach for a subset of hybrid connections.

3.11 Should any special allowances for innovation technologies be included in the Phase Two process?

Ireland has committed to achieving net zero carbon emissions by 2050. For this goal to come to fruition, the power sector, and indeed the wider energy system will need to be fully decarbonised well in advance of this timeframe. ESB has just recently also launched a strategy to meet net zero by 2040. Innovative technologies and approaches will be critical in realising these ambitions and should be supported to allow them to be tested and refined to contribute to this ambitious objective.

Accordingly, ESB would recommend that all forms of innovation should be supported in parallel to the mainstream technologies that will deliver the majority of the 2030 target. It is equally important to recognise that not all innovative technologies are at the same point on the journey to commercial operation. Floating offshore wind, for example, is already in commercial operation in a number of global locations and deployment in the next decade will comprise multiple gigawatts while wave technology has not reached the same level of commercial advancement. As such, approaches to the support of innovation in its widest sense should not be based on a “one size fits all” basis.

a) What technologies should be provided with special allowances and why?

Floating offshore wind should not be considered an innovation project (unless a specific novel technology is being developed as set out below) and should therefore be supported through a separate ORESS auction or pot within ORESS 2. Such an approach is in line with that adopted by other nations such as the UK. In that specific example, early recognition of the potential for floating offshore wind in the UK CfD auction process has led to a burgeoning sector with large scale commercial deployment planned for the Atlantic, the North Sea and the Celtic Sea.

It would not be appropriate for other projects with less mature technology to compete at auction. Again, experience from elsewhere has demonstrated that early-stage technologies should be supported through some type of feed in tariff to provide a higher degree of certainty for the technology providers.

Ireland has a tremendous opportunity to develop a major indigenous energy storage capability and improve its long-term energy security. This can be achieved by scaling out floating offshore wind to produce green hydrogen at scale that can then be stored in large-scale energy storage in sub-sea salt caverns and depleted gas fields. This capability will be key in solving the issue of renewables intermittency but also critically will provide Ireland with very significant energy security benefits at scale. The building blocks to deliver these solutions are available and can be materially advanced before 2030. It is critically important that the Government signals early support to these projects so that they can move towards full commercial deployment as soon as possible. Waiting for other nations to do the "heavy lifting" risks losing the potential benefits that can accrue to the wider economy.

Zero carbon energy hub demonstrations which combine offshore wind, large scale hydrogen production by electrolysis, hydrogen storage and zero carbon dispatchable power generations fuelled by renewable hydrogen should be supported through MAC allocation under phase 2. These hubs represent a glimpse into energy sites of the future that will help secure Ireland's zero carbon energy system. The scale of these hubs should be in the order of 600MW of floating wind with at least 200MW of electrolysers included to produce Hydrogen per project. The innovation aspect of these projects should not be limited to technologies used but include all innovative approaches (e.g., unit configuration, new business models, and trading between units) that can be harnessed to maximise the value of these hubs to the wider Irish energy system. These hubs should be given the flexibility to combine some of these technologies and different approaches to develop an innovation project for support. The development of these projects should also be supported and included in Ireland's National Hydrogen Strategy.

Ireland is also blessed with some of the greatest wave resources in Europe. Wave energy is a suitable 'companion technology' to Offshore wind and synergies may be possible, such as sharing a grid connection for example. In addition, wave energy's production profile tends to be 'offset' from wind energy's profile, and therefore complimentary. Advancing wave energy technologies in Ireland would help maximise the potential from Ireland's vast ocean energy resource. Leading wave technology, while still pre-commercial, has advanced steadily in recent years. For example, two technologies tested in Orkney, Scotland, have been deployed successfully in extreme wave conditions comparable to those found off Ireland's West coast. Wave technologies should be supported along with other new emerging technologies such as tidal energy devices and 'floating wind and hydrogen' hybrid platforms within Phase Two.

b) What allowances should be made? At what stage(s) of the Phase Two process? Should capacity be reserved in the MAC and ORESS processes for any of these technologies?

As outlined elsewhere in this response, the SOEF does not provide sufficient headroom to make sure that the 5GW target is achieved. To allow for attrition, delays to consent, difficult network upgrades etc., there needs to be at least an additional 2GW of capacity identified in the SOEF at more geographically diverse locations. Such additional capacity would allow floating offshore wind projects to compete for MACs either as part of the general Phase Two process or in a specific MAC allocation process. The allocation for floating offshore projects in MACs needs to be replicated in the ORESS auction process.

It is critical that additional MACs are allocated to allow zero carbon energy hubs demonstrations (as discussed above) to progress prior to 2030. Priority should be given to these projects in the most strategic locations (e.g., adjacent to sub-sea salt caverns and depleted gas fields.) Support outside of RESS would have to be considered for these projects as they are no longer only producing renewable electricity. A deeper analysis of how best to support these projects should be considered in the development of the National Hydrogen Strategy.

Additional MACs should also be awarded to emerging technologies, though the capacity of these projects should be limited to not sterilise grid capacity for mainstream fixed and floating offshore wind projects. Support should be provided in the form of a feed in tariff to progress 70MW of wave and tidal energy projects (including wave embedded in floating wind platforms) to allow innovation projects associated with these technologies to come forward. This will put Ireland in a strong position to deliver these types of projects on commercial scale post 2030 in the Enduring Regime.

A similar support should also be provided for up to 150MW of 'floating wind and hydrogen' hybrid platform projects with no single project exceeding 100MW. Again, this will bring forward strategically important hydrogen innovation projects but also better positioning Ireland to deliver these types of projects on commercial scale post 2030. The cap of 100MW per project ensures that there is flexibility available to allow potential for both a wide range of innovation projects but also allow deployments at pre commercial scale development should the technology development allow. A similar approach has been taken by the Scottish Government in its proposed Sectoral Marine Plan for Offshore Wind for Innovation and Targeted Oil and Gas (INTOG) which will further underpin Scotland's road to decarbonisation. In terms of innovation, the plan is considering Innovation/Test and Demonstration projects in the course of its development which is proposed to be limited to identifying and delivering plan options up to 500 MW. Individual projects are proposed at less than 100 MW total generating capacity

c) Should these types of projects also be required to deliver by 2030?

Floating offshore wind can be deployed by 2030 but delivery in that timeframe will be heavily influenced by the actions taken by the Government and MARA. Delivery by 2030 is therefore a decision for the Government rather than the developers.

Regardless of whether delivery is pre or post 2030, the most important point is that development of offshore wind should commence as soon as possible for a number of reasons. The Climate Action Plan references both a target of at least 5GW of offshore wind by 2030 to be followed by at least another 30GW as set out in the Programme for Government. It will be floating offshore wind that will deliver the vast majority of the additional 30GW and the development of the 5GW and the 30GW should not be sequential – commencement of floating deployment now will help avoid a hiatus in the 2030s.

Unliked fixed offshore wind, floating has the potential to create a bespoke supply chain in Ireland with all of the associated economic benefits. A report on behalf of ESB GT by BVG Associates has indicated that just one 400MW floating offshore project has the potential to create almost €1b in Gross Value Added (GVA) to Ireland as well as more than 12,000 direct, indirect and induced jobs. There is a real risk that, if Ireland delays the deployment of floating offshore, the supply chain opportunities will be lost to other markets that are pushing ahead such as Scotland, England and France.

As regards to innovative technologies such as hydrogen, storage, wave and tidal, etc., none will make a significant contribution to 2030 targets. The most important aspect regarding innovation technologies is to ensure that support is provided as soon as possible as part of the pathway to full scale commercialisation post 2030. It is therefore not essential that innovation projects should deliver by 2030.

d) What level of offshore wind capacity could be deployed before and after 2030 that does not depend on the Irish grid for offtake? i.e. generation that is instead utilised for non-grid offtakes such as green fuel generation or export by cable to another jurisdiction?

Experience in other mature offshore wind markets has demonstrated that little, if any, capacity thus far has not been grid connected. There are several projects in Europe and elsewhere that are being developed which do not depend on linking in with the grid. These tend to fall into two categories – those designed to decarbonise the oil and gas sector and those designed to generate hydrogen. An example of the former is the under construction Hywind Tampen project comprising 11 turbines not connected to the grid but to oil and gas platforms in the North Sea to provide most of their electrical power. In terms of hydrogen, a Danish project is under development which hopes to use the output from a 1GW offshore wind project to generate hydrogen using electrolysers. A similar project nearby intends to use a similar offshore wind project to produce green ammonia. A further example is the proposed Sectoral Marine Plan for Offshore Wind for Innovation and Targeted Oil and Gas (INTOG) in Scotland. which seeks to identify up to 4GW of projects to decarbonise the Oil and Gas Sector offshore.

While it is possible and even likely that these and similar European “grid alternative” offshore wind projects will be operational by 2030, it is unlikely that there would be similar projects of scale available in Ireland by 2030. It is also true however that such projects are likely to be the mainstay of the Irish energy system beyond 2030 given the disconnect between energy resource availability and conventional electricity demand. It is therefore important that work commences now to help develop initial pilot projects to demonstrate and test the technology and operation of offshore projects not connected to the grid infrastructure.

Date: 4. March 2022

To: ESB

From: VESTAS OFFSHORE WIND A/S

Re.: Phase 2 Consultation

The purpose of this document is to set forth the general support of the implementation of floating offshore wind (FOW) and prioritisation of the technology in Phase 2 of the RESS process on behalf of Vestas Wind Systems A/S.

Ireland have committed to reaching 5GW of offshore wind by 2030, 3GW of which is set to be allocated in Phase 2. We appreciate that the majority will be fixed bottom, but floating technologies and projects must be considered. Vestas believes that a separate pot must be allocated to FOW and recommend that an additional 1GW of FOW be allocated on top of the 5GW already planned by 2030. It is our belief that, should Ireland hope to achieve the targets it has set by 2030, FOW will have to make a substantial contribution to ensure continuity of the market and readiness for a larger deployment of FOW thereafter. We need to aim higher than the 5GW target, and we need at least 1GW of FOW in the form of commercial projects to kickstart the industry. A larger project and hence potential start of a FOW pipeline will make Ireland a more attractive industrial hub.

Studies show that Ireland is located in a prime position for FOW developments, with strong wind resource, along with environmental and geographical conditions well suited to floating offshore wind. There is a vast abundance of available and appropriate space for the implementation of floating offshore wind farms in the Irish marine basin, distributing the benefits of offshore wind to other parts of the country. The physical conditions of the ocean floor, paired with the high wind speeds and wide, open ocean space mean that the waters off the west coast of Ireland are effectively a strong location for FOW technology. The size of the Ireland's designated marine space means that the options for floating offshore wind energy are immense. Furthermore, Ireland has some of the best wind resources in Europe.

For those reasons, we would take this opportunity to ask you to support the development of FOW and to keep this among your offshore ambitions before any decisions you make regarding planning and consenting going forward. Policy efforts should focus on collaboration between government, regulatory authorities, and the offshore wind industry to best utilise Ireland's vast offshore and FOW resources.

Vestas has been involved in several demonstration floating projects across the globe. Our experience shows that as a turbine manufacturer, the differences between floating wind and fixed-bottom offshore are minimal and the technology is ready and available for mass deployment. The maturity of FOW technologies is demonstrated and showcased in our 25.2 MW WindFloat Atlantic project in Portugal and 50 MW Kincardine project in Scotland.

Some of the key transition technologies developed in conjunction with floating offshore wind development already cost significantly less than many industry professionals predicted. Key technologies, including wind, solar and batteries have globally fallen in price, to the extent that they are becoming cost competitive with fossil fuels. Every indication points to FOW will following that path. Policy has been a key driver in accelerating this innovation, and as such, it must continue to do so, especially if Ireland wants to be part of fast growing global offshore and FOW supply chain and industrial opportunity. The technical advancements which have resulted from the development of floating offshore wind projects should be recognised and continuously built upon and backed by vigorous policy requirements and strategies. Policymakers have the ability to facilitate technological advancements through the development of frameworks to the benefits of the Irish economy. These are necessary to progress in technological development, commercial deployment as well as cumulate investment. As mentioned, Vestas believes a good place to start is with a separate pot allocated to FOW and recommend that an additional 1GW of FOW be allocated out on top of the 5GW already planned by 2030.

Early support and demonstration of floating substructures has matured the technology to the point where it is ready for commercial deployment. Policymakers should turn their focus on making decisions that lead to the construction of large-scale projects that trigger economies of scale in floating technologies, securing their optimisation and competitiveness in Ireland. Currently, developers face challenges due to the time taken to obtain the required permits and financial support necessary for a project. In markets where decisions and timescales for permitting move faster, we have seen greater progress and benefits without sacrificing competitiveness or safety. Note that the UK is now moving to annual auctions.

Furthermore, there has been discussion around the potential for these FOW turbines to contribute to the production of hydrogen. Further research is required to identify the extent to which this form of hydrogen creation could contribute to Ireland's energy demand, however we have no doubt that it plays a significant role in decarbonisation. As with FOW, decisions have to be made now to see this come to fruition by 2030.

We can learn from the ambition shared by Crowne Estate Scotland and the ScotWind leasing round and leverage the landscapes and the environmental conditions that make Ireland the ideal beneficiary for FOW. Ireland must now look to the future and think long term.

Kind Regards,

Kresten Ørnbjerg
Vice President, Global Public Affairs

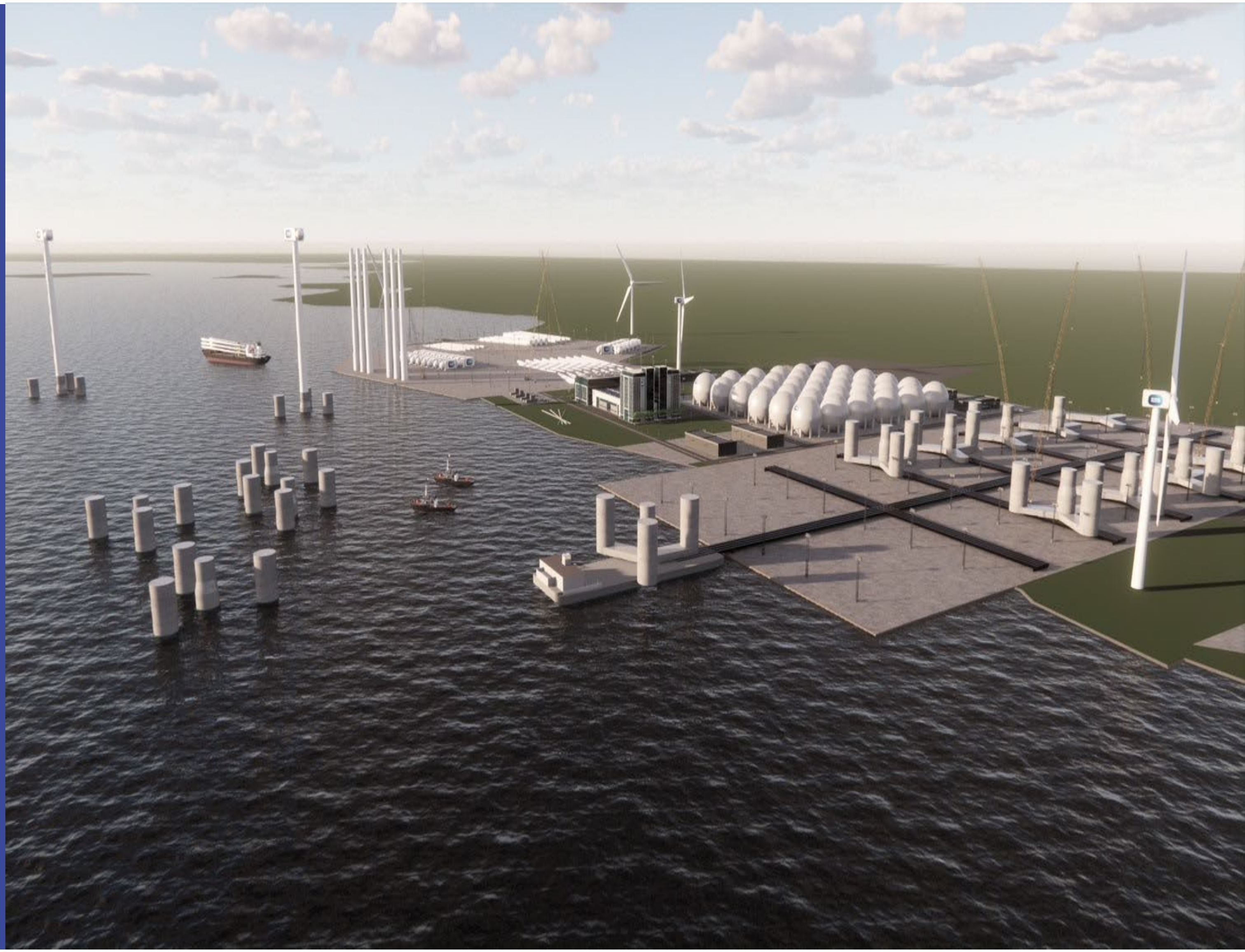
Vestas Wind Systems A/S

BVG Associates

Green Atlantic @ Moneypoint: a socio-economic impact report

Final report

November 2021



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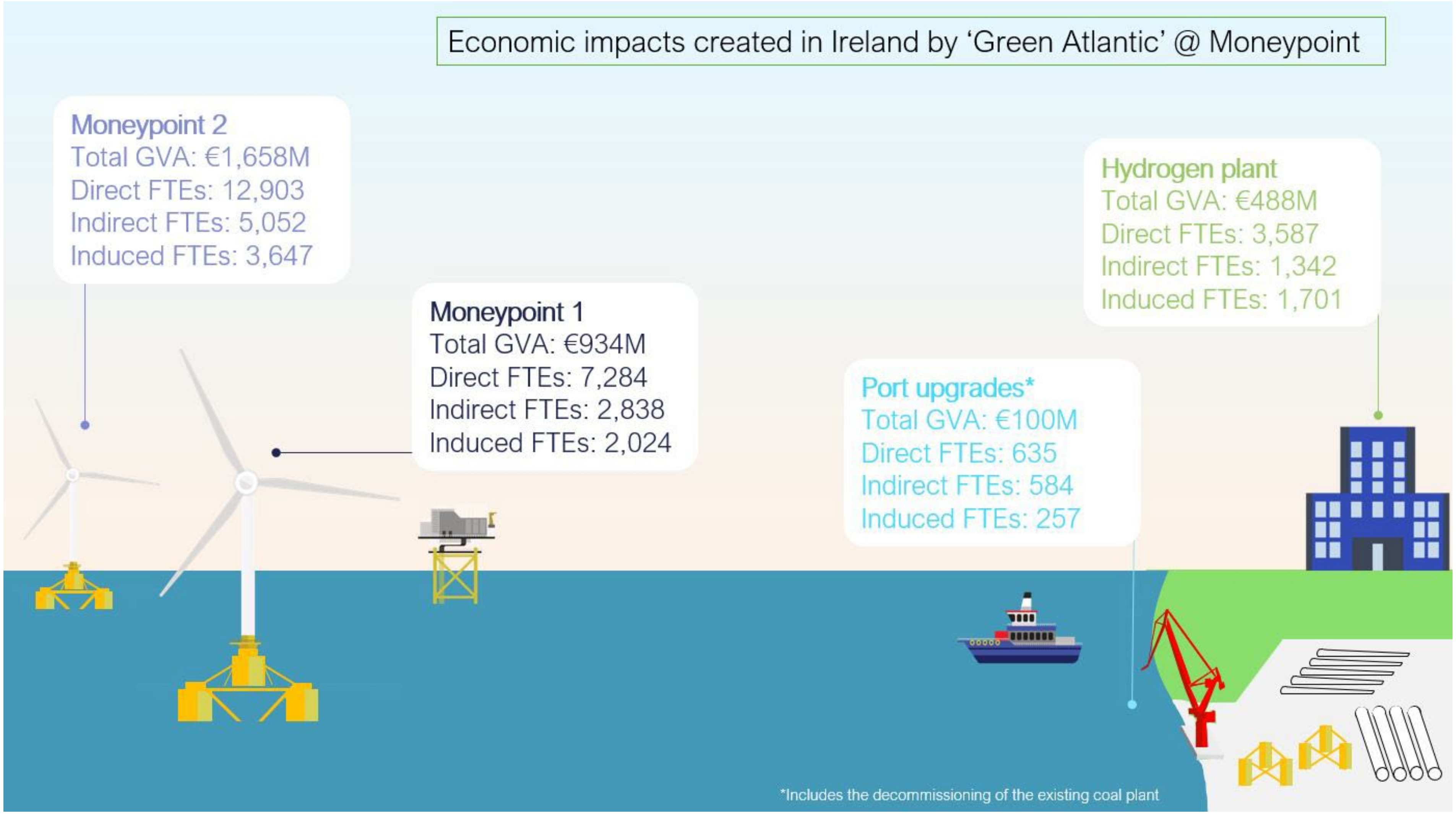
Economic impacts created in Ireland by 'Green Atlantic' @ Moneypoint
Moneypoint 2
Total GVA: €1,658M
Direct FTEs: 12,903
Indirect FTEs: 5,052
Induced FTEs: 3,647
Moneypoint 1
Total GVA: €934M
Direct FTEs: 7,284
Indirect FTEs: 2,838
Induced FTEs: 2,024
Port upgrades*
Total GVA: €100M
Direct FTEs: 635
Indirect FTEs: 584
Induced FTEs: 257
Hydrogen plant
Total GVA: €488M
Direct FTEs: 3,587
Indirect FTEs: 1,342
Induced FTEs: 1,701
*Includes the decommissioning of the existing coal plant

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1. Introduction

ESB is exploring the opportunity to repurpose the existing Moneypoint power station into a "renewable energy hub". Moneypoint is a primarily coal-fired power station, with the capability also for oil fired electricity generation.

In line with ESB's 'Green Atlantic' vision for the future of Moneypoint, and the harnessing of floating wind energy from the Atlantic Ocean, part of the Moneypoint Station site is to be converted into a floating wind hub in the next number of years.

ESB has commissioned this independent report from BVG Associates (BVGA) to assess the socio-economic impacts of the project.

This facility, when constructed, will act as a dual-purpose deployment hub for the deployment of the proposed Moneypoint 1 and 2 wind farms (0.4GW & 1GW respectively). The operational requirements for the facility are two-fold: to act as a staging point for the mating of wind turbines onto floating foundations prior to their tow-out to the wind farm site, and to act as a construction site for the fabrication/storage of the steel or concrete floating foundations. An O&M depot for the servicing and maintenance of the Moneypoint 1 and 2 wind farms, along with third-party offshore windfarms into the future will also be developed on site.

Additionally, it is proposed to develop a 1GW green hydrogen electrolysis facility on site, with electricity supplied by future offshore floating wind projects. The newly developed facility infrastructure will allow for the potential export of hydrogen fuel for use overseas, retention of the fuel in Ireland for domestic use, and ancillary distribution such as ship refuelling.

A project of this scale will be significant for the development of the offshore wind industry in Ireland, contributing to the creation of jobs both locally in County Clare and across the rest of Ireland.

This report assesses the economic impacts, measured using gross value-added (GVA) and full-time equivalent (FTE) years, that the new Moneypoint site, the two associated offshore wind farms, and hydrogen plant will generate during their development, construction, and lifetime operation. Two scenarios were assessed – using either steel or concrete for the floating foundations.

This report also assesses the potential CO_2 emission savings that could be made if the electricity produced by the planned offshore wind farms replaces coal-powered generation. The project's impact on other socio-economic factors such as average income and local housing prices are also considered.

For modelling purposes, the project was split into four phases:

1. Port upgrades
2. Moneypoint 1 floating wind farm (400MW)
3. Moneypoint 2 floating wind farm (1,000MW), and
4. the hydrogen plant (1GW).

Following the deployment of the initial two wind farms, there is the potential for further floating offshore wind deployment out of the new Moneypoint facilities. The economic benefits of deploying 500MW of floating offshore wind annually for 20 years (2034-2053) are evaluated.

2. Methodology

Overview

The work was undertaken in the following stages:

- Moneypoint 1 and 2:
  - Supply chain narrative, which assessed the materials and services required, and potential suppliers for these in both County Clare (local) and the rest of Ireland.
  - Quantitative socio-economic impacts, showing the positive economic impacts of the projects in terms of gross value added (GVA) and full-time equivalent (FTE) employment years, both locally and in the rest of Ireland.
  - Industry-specific impacts, which assessed the project's contribution to decarbonisation by calculating carbon savings over its lifetime. The project's impact on offshore levelised cost of electricity (LCOE), and the potential to facilitate future floating projects off Ireland's west coast, were also considered.
  - Qualitative socio-economic impacts, which evaluated the project's impact on factors such as local employment levels, housing prices, and average income.
- Outlook to 2050 and beyond:
  - Supply chain narrative, which assessed developments in the supply chain over time
- Economic impacts, which assessed the economic benefits of deploying 500MW of floating offshore wind annually following the commissioning of the Moneypoint 2 wind farm.

Moneypoint 1 and 2

Supply chain narrative

The first task of the work was to build a narrative of the products and services that could be supplied locally or nationally for each phase of the project.

This process was informed by:

- ESB's intentions for the project
- The local and national economic and infrastructure strengths
- Specific known supplier capabilities, and
- The logistical benefits of sourcing locally or nationally.

For the two winds farms, the supply chain was split into two category levels, as shown in Table 1.

We have estimated the FTE and GVA for both concrete and steel floater construction. The distinction is of interest as concrete floaters will result in significantly more Irish contribution than steel floaters will. We do not state which option is likely to be preferred. The floating technology and materials employed for foundation construction will be determined on a project-by-project basis by the project developer, taking into account a number of factors such as commercial, environmental and engineering requirements for each development.

Table 1 Supply chain categories for Moneypoint 1 and 2 wind farms

Expenditure type	Level 1	Level 2
DEVEX	Development and project management	Developing and permitting
		Project management (technical and non-technical)
CAPEX	Turbine	Nacelle, rotor and assembly
		Blades
		Tower
	Balance of plant	Foundation supply
		Array cable supply
		Export cable supply
		Onshore and offshore substation supply
	Installation and commissioning	Turbine installation
		Foundation installation
		Array cable installation
		Export cable installation
		Substation installation
OPEX	Operations, maintenance and service	Wind farm operation
		Turbine maintenance and service
		Balance of plant O&M
		Transmission maintenance
		Vessels
	Decommissioning	Decommissioning

Quantitative socio-economic impacts

Following the supply chain analysis, and using the resulting local and Irish content splits, the economic modelling was carried out. The economic impacts of each project phase were measured by two key metrics:

- GVA
- FTE years

These metrics were modelled locally and nationally.

GVA and FTE analysis

Gross value-added is the value generated by any unit engaged in the production of goods and services. Essentially, the value added to a region is equal to the amount spent within the region plus the induced spending that results from this.

One FTE year means one full-time job for one year.

The economic model uses the following key inputs:

- budgetary data (supplied by ESB)
- content percentage estimates
- lifetime expenditure estimates,
- and salary and employment statistics.

Salaries and employment costs were researched from public sources, from data collected by BVGA during previous analysis, and using relevant salary data collected by the Central Statistics Office of Ireland.

For the two proposed wind farms, the methodology used was developed specifically for the offshore wind sector by BVGA. Our approach is described in more detail in Appendix B.

BVGA has gathered a significant amount of data over 10 years on the local and national content of offshore wind farms and number of jobs associated with different offshore wind activities. The results of the analysis were validated using this data.

Our modelling calculates direct, indirect, and induced GVA/FTEs. These have the following definitions:

- Direct refers to workers employed by the project itself (e.g., those constructing the floating substructures in port).
- Indirect refers to those that work to supply the project with goods and services (e.g., the workers in the quarries that provide the materials for the substructures).
- Induced refers to the jobs created as a result of the increased economic activity from direct/indirect spend (e.g., the food service industry that caters for the direct /indirect workers).

All costs are in 2020 Euros.

Industry specific impacts

The industry specific impacts were split into three categories:

- Contribution to decarbonisation
- Impact on the LCOE of future floating projects, and
- Contribution to the success of floating wind projects off Ireland's west coast

Contribution to decarbonisation

For each phase of the project, carbon savings were estimated.

For the port upgrades and construction of the hydrogen plant, there are no carbon savings, only carbon expenditure (embodied carbon). Carbon expenditure was estimated by assessing the materials and services required and calculating the carbon output for each from the manufacture of materials, transportation, etc.

For the construction and operation of the wind farms, carbon expenditure was estimated by taking the typical embodied carbon of offshore wind, per unit of energy produced, and applying to the two farms.

Carbon savings were estimated by comparing the lifetime carbon output of the wind farms, per unit of electricity produced, to that of the existing coal power plant. Annual electricity production (AEP) was estimated by multiplying the rated capacity of the wind farms by hours in a year and the estimated capacity factor of the farms. The AEP was then multiplied by the carbon output from producing an equivalent amount of electricity from coal to get carbon savings.

These savings were subtracted from the carbon expenditure from the rest of the project to give carbon savings for the project as a whole. The carbon payback period (the time taken for savings to exceed expenditure) was also calculated.

All carbon emission factors used were sourced from 'Sustainable Energy Authority of Ireland, 2020 energy-related CO_2 emissions in Ireland' report.

Impact on LCOE of west coast floating wind projects

The development of the Moneypoint site into a renewable energy hub is expected to provide positive impacts to offshore wind projects off Ireland's west coast beyond the two planned farms considered in this report. To quantify this impact, we ran our LCOE model for Moneypoint 2 with and without the new port facilities at Moneypoint. The key contributing factors to the change and a high-level breakdown of the cost differences using our standard wind farm taxonomy are included.

Contribution to the success of floating wind projects

Building on the quantitative analysis from the LCOE model, we have provided a qualitative narrative by looking at limitations of existing infrastructure and how the new Moneypoint facilities would help mitigate them. We have referred to Ireland's upcoming renewable energy goals and shown how the new Moneypoint site can help in achieving them.

Qualitative socio-economic impacts

We have looked at various socio-economic metrics that could possibly be affected by the new Moneypoint site:

- Tourism
- Population and demographics – population, growth, density, migration levels
- Land use – designated land use types
- Income and employment – household income, employment levels, occupations, economic activity level
- Community – deprivation, crime, life expectancy
- Education – skills base, education, qualification level, technical colleges, universities, engineering competence
- Transportation and other infrastructure – access to public transport, commuting trends, broadband connectivity.
- Housing – prices, stock, tenure (rent or owned), and
- Business - sectors and local industry.

We have built a picture of where these factors are at before the new developments, and where we expect them to be after. We have considered whether the impact on these indicators will be positive, negative, or neutral.

Outlook to 2050 and beyond

Supply chain narrative

As with the analysis of the Moneypoint 1 and 2 wind farms, a supply chain narrative for the continued annual 500MW deployment was built. To avoid repetition, this section only highlights changes to local content from the Moneypoint 1 and 2 analyses, and how the local content changes over time for each supply chain area.

Content figures are given for County Clare (local) and the rest of Ireland and are in five-year increments.

Economic impacts

GVA and FTEs were calculated using the same methodology as the Moneypoint 1 and 2 analyses. Content percentages were established as described above. Costs for each stage of a wind farm were evaluated to 2053. An Irish and global floating forecast was established and learning rates were used to calculate cost reduction over time. In this scenario, 500MW is deployed from Moneypoint annually for 20 years, or around 12GW by 2053. It can then be assumed that Ireland will likely meet and probably exceed its offshore goal of 35GW. This favourable outlook not only drives down cost over time, but also influences the supply chain narrative.

As with the Moneypoint 1 and 2 analyses, GVA and FTEs were calculated locally and for Ireland, and broken down as direct, indirect, and induced.

3. Moneypoint 1 and 2

Supply chain narrative

Port upgrades

For the port upgrades, costs were taken from a previous study conducted by RPS Group (commissioned by ESB). Content splits, both locally and for Ireland, were established by breaking down the cost of each activity into materials, labour, equipment, and profit/overhead, and defining the source of each.

The land-side upgrades are all general civils/groundworks, and can be sourced locally, with some materials and most equipment costs being imported.

Quayside upgrades include marine civils, which can use contractors from the rest of Ireland. Like the land-side upgrades, some materials and most equipment costs will be imported.

For this phase of the project, we estimate that 32% of content will be local and 36% from the rest of Ireland, totalling 68% from Ireland.

The port upgrades expenditure, broken down by activity, and the associated content splits, are shown in Table 6.

Moneypoint 1 and 2 wind farms

Development

For the project management and surveying work, it was assumed that Irish contractors can be utilised where possible.

Engineering and design services can all be delivered by companies with an Irish presence. For specialist technical consultancy and surveying work, it was assumed that European contractors will be used, with the potential for some to be Irish.

For the development of Moneypoint 1 and 2, we estimate that 23% of content will be local and 40% from the rest of Ireland, totalling 63% from Ireland.

Wind Turbines

As Ireland currently has no factories capable of supplying the rotor, nacelle, tower, generator, or any other major component of the turbine, we have assumed that they will be supplied from European suppliers. Therefore, both local and Irish content for this part of the projects will be 0%, even though it contributes a large portion of the total expenditure. We have not assumed any change in Ireland's facilities within the timeframe considered. There is the possibility for Ireland to develop this aspect of the supply chain further down the line. If Ireland reaches its offshore goals, a local turbine manufacturing plant would allow it to capture a larger share of total content.

Balance of plant

Balance of plant includes the supply of the foundations, export and array cables, onshore and offshore substations, and operational infrastructure.

For the steel foundation scenario, it is assumed that modular steel floaters will be used. These can be partially fabricated in a low-cost labour market, such as Poland, and partially fabricated in Ireland. Final assembly would take place at the Moneypoint port. As Ireland has limited steel rolling capabilities, the main columns of the substructure would have to be imported, with the modular design allowing for them to be shipped via container. The rest of the steel, such as the water entrapment plates, trusses, and secondary steel, can feasibly be manufactured in Ireland. Final assembly, welding, and painting can all take place at the Moneypoint port, using local labour.

If concrete substructures are used, it is assumed that they will be constructed on-site at Moneypoint. Labour will be locally sourced, and materials would be a mixture of local (aggregate), Irish (cement) and imported content (steel/sand).

For the mooring system, anchors can be designed by foreign contractors, with the manufacturing taking place in Ireland. The mooring chains themselves can be designed in Ireland and manufactured in Europe.

As there are no heavy-duty subsea cable suppliers in Ireland, export and array cables will need to be imported from Europe. There is the potential for some of the cable protection systems for the array cables to be manufactured in Ireland, accounting for 5% of total array costs.

The offshore substation topside will need to be imported, but some low voltage equipment and some building materials can be sourced from within Ireland.

Like the onshore substation, operational infrastructure building materials and low-voltage electrical equipment can be sourced both locally and from the rest of Ireland.

For balance of plant overall, if steel foundations are used, 11% of content will be local and 27% from the rest of Ireland, totalling 38% from Ireland. If concrete foundations are used, 30% of content will be local and 15% from the rest of Ireland, totalling 45% from Ireland.

Installation and commissioning

Turbine installation will use the Moneypoint port, allowing for the use of Irish cranage contractors for the mating of the turbines to the foundations. Most other aspects of installations and commissioning will need to use experienced installation companies from the offshore wind industry. Ireland does not have many vessels suitable for these works, but there is the possibility of using Irish anchor handling tugs to tow the mated turbine-foundations out to site.

International vessels will need to be used to pre-install the mooring systems, as this requires large vessels with subsea drilling capabilities.

International vessels will also need to be used for the installation of the offshore substation, the array and export cables, and any scouring protection that needs to be laid.

Local/Irish contractors can be used for some of the onshore installation works, including laying the onshore portion of the export cable, installing the onshore substation, and construction of the O&M base.

Overall, 15% of content will be local and 28% from the rest of Ireland, totalling 43% from Ireland.

Operation, maintenance and service

With Moneypoint being used as the O&M base for the wind farms, much of the content can come from local or Irish sources.

This includes wind turbine technicians, balance of plant technicians, vessel crew and other operational staff.

Moneypoint 1 and 2 will likely use service operation vessels (SOVs) for their servicing and maintenance needs, meaning no Irish vessels will be used. However, local/Irish personnel will be able to staff the vessels that are used. Additionally, Irish tugs can be used to tow turbines back to port for major repair works.

For this stage, 31% of content will be local and 20% from the rest of Ireland, totalling 51% from Ireland.

Decommissioning

Decommissioning involves similar processes and skills to that of installation. It was assumed that Irish anchor handling tugs would tow the turbines back to port, where they will be removed from the foundations using land-based cranes. Decommissioning of the offshore substations and subsea cables would still require international vessels to be used.

For this stage, 18% of content will be local and 35% from the rest of Ireland, totalling 53% from Ireland.

Moneypoint 1 and 2 expenditures, broken down by activity, and the associated content splits are shown in Table 7 and Table 8.

Hydrogen Plant

We calculated economic impacts based on a 1GW hydrogen production system at the existing Moneypoint powerplant site. The hydrogen production plant consists of electrical equipment interconnecting the electrolyser plant to the offshore wind farm, an electrolyser system incorporating cell stack modules, water pre-treatment, gas treatment, power electronics, hydrogen compressors, and hydrogen storage.

A building will house the electrolyser and associated equipment, while compressor and hydrogen storage will be located outside. It is envisioned that some of the existing Moneypoint powerplant buildings will be repurposed for the hydrogen plant. A quayside export terminal was also included in the design for the purpose of exporting hydrogen via ocean vessel. Any other equipment such as hydrogen vehicle refuelling, gas grid injection equipment, or hydrogen turbine generator was not included in our assessment.

We assumed that the project development and project management for any hydrogen production facility would be carried out by Irish based companies, with a mixture of local contractors undertaking survey work, and contractors throughout the rest of Ireland providing other development and project management work packages, this includes staff at ESB's HQ.

The largest single CAPEX item for a hydrogen project is the electrolyser. Electrolysers are manufactured using a serial semi-automated production process. The primary electrolyser manufacturers are ITM Power, Nel, Siemens, and Cummings (via its acquisition of Hydrogenics). None of these manufacturers are currently based in Ireland and we have therefore assumed that no local or Irish jobs or GVA will arise from electrolyser manufacture. Furthermore, most of the electrolyser costs are associated with the materials and sub-components, and there is minimal value added during final electrolyser assembly. As such, even with a manufacturing facility located in Ireland, jobs numbers associated with manufacture of electrolysers would be relatively low, on the order of 100-200 people per GW, as is the case for electrolyser factories elsewhere in Europe.

Outside of the electrolyser system, the remaining balance of plant equipment, such as medium voltage electrical equipment, hydrogen compressors, hydrogen, and storage vessels, are unlikely to be sourced from Irish suppliers, as many of these items for existing hydrogen projects are being supplied from outside of Ireland, from suppliers in the UK and mainland Europe, and no existing Irish suppliers were found in our research. However, civil engineering, construction, and equipment installation would be carried out by Irish based companies using Irish personnel and are likely to rely on well-established supply chains associated with the Moneypoint power plant.

We assumed that the operations and maintenance of the hydrogen production facility will be delivered by a mixture of locally based personnel employed by the Moneypoint facility, supported by remote teams employed by equipment OEMs.

Although local and Irish content here is relatively high, the percentage of expenditure for O&M activities related to personnel has assumed to be around 50% of the cost of an O&M contract, with the remaining 50% covering spare parts and materials – the majority of which would be supplied from OEM manufacturing facilities outside of Ireland.

Overall, local and Irish content for the Moneypoint hydrogen production plant is associated with project development and project management, engineering, civils, construction, and installation, and O&M work packages. It is expected that manufacturing of large components such as electrolysers, hydrogen storage, and hydrogen compressors will be done outside of Ireland. This could change over the next decade; particularly for the easier-to-manufacture components such as hydrogen storage vessels.

This results in around 6% of content being sourced locally with a further 6% from the rest of Ireland, totalling 12% for Ireland.

The hydrogen plant expenditure, broken down by activity, and the associated content splits are shown in Table 9.

Total expenditure and content splits

The four phases of the project - port upgrades, Moneypoint 1, Moneypoint 2, and the hydrogen plant – have a total expenditure of €9.5 billion and €9.4 billion for the steel and concrete foundation scenarios, respectively. Figure 1 shows this expenditure split by project phase, and local/rest of Ireland content for the steel foundation scenario. The equivalent concrete scenario chart is shown in Figure 2.

Sourve: BVG Associates

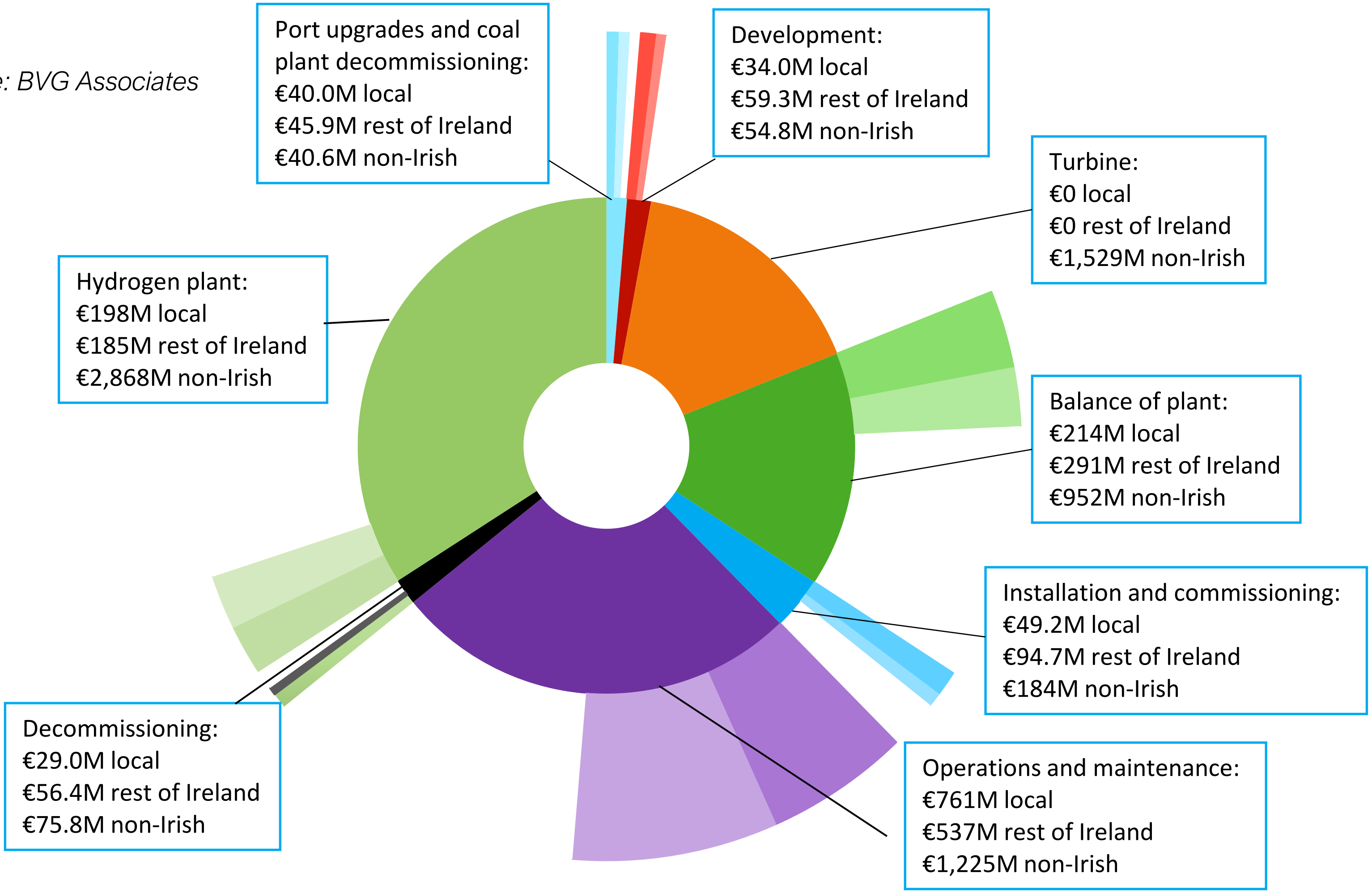

Figure 1 Expenditure splits - steel foundation scenario

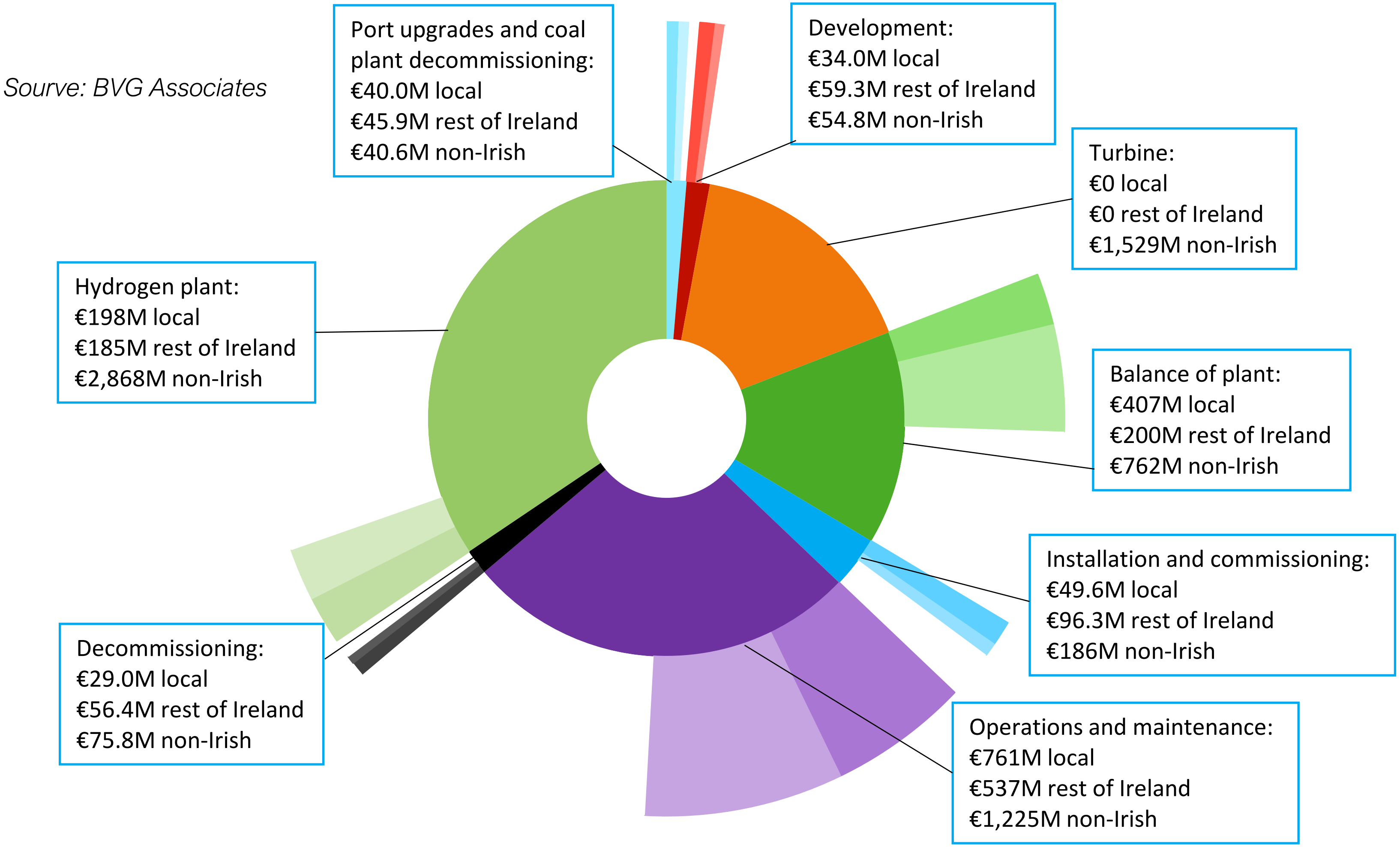

Figure 2 Expenditure splits - concrete foundation scenario

Quantitative socio-economic impacts

Total GVA and FTEs

To evaluate GVA, we take the direct expenditure breakdown presented in the previous section and add in the induced expenditure.

Irish GVA for the full project (including port upgrades, both wind farms, and the hydrogen plant) was calculated to be €3.08 billion for the steel foundation scenario, and €3.18 billion for the concrete foundation scenario. This translates to 40,112 and 41,855 FTE years for the two scenarios, respectively, over the lifetime of the projects. Note that these numbers include direct, indirect, and induced GVA/FTEs. The breakdowns of direct, indirect, and induced GVA and FTEs for both steel and concrete foundation scenarios are shown in Table 2 and Table 3.

Table 2 Direct, indirect, and induced GVA/FTEs for steel foundation scenario

Steel	Ireland		Of which local	
	GVA	FTE years	GVA	FTE years
Direct	€1,729M	22,660	€994M	12,610
Indirect	€867M	9,780	€332M	3,468
Induced	€491M	7,682	€157M	2,598

Table 3 Direct, indirect, and induced GVA/FTEs for concrete foundation scenario

Concrete	Ireland		Of which local	
	GVA	FTE years	GVA	FTE years
Direct	€1,830M	24,410	€1,139M	15,141
Indirect	€869M	9,816	€379M	4,111
Induced	€482M	7,629	€171M	2,978

Of the €3.08 billion GVA in the steel scenario, €1.48 billion will be local. Of the €3.18 billion GVA in the concrete scenario, €1.69 billion will be local. This translates to around 18,676 and 22,230 local FTE years for the two scenarios, respectively.

It is expected that the concrete floater option would generate slightly higher local and national job numbers and GVA given the greater proportion of floater construction in Moneypoint than the steel option.

The full breakdowns of GVA and FTE years by project phase for the steel and concrete scenarios are shown in Table 10 and Table 11 in Appendix D.

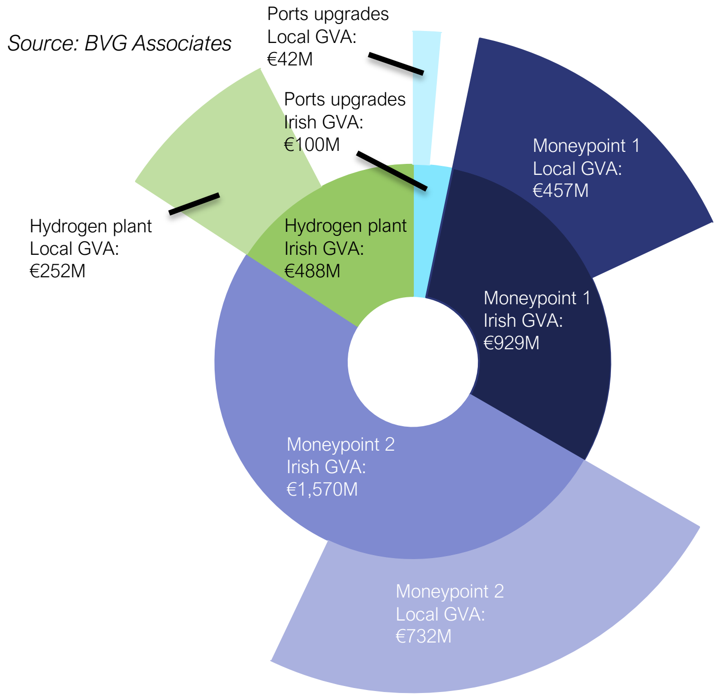

Figure 3 Local and Irish GVA by project phase – steel foundation scenario

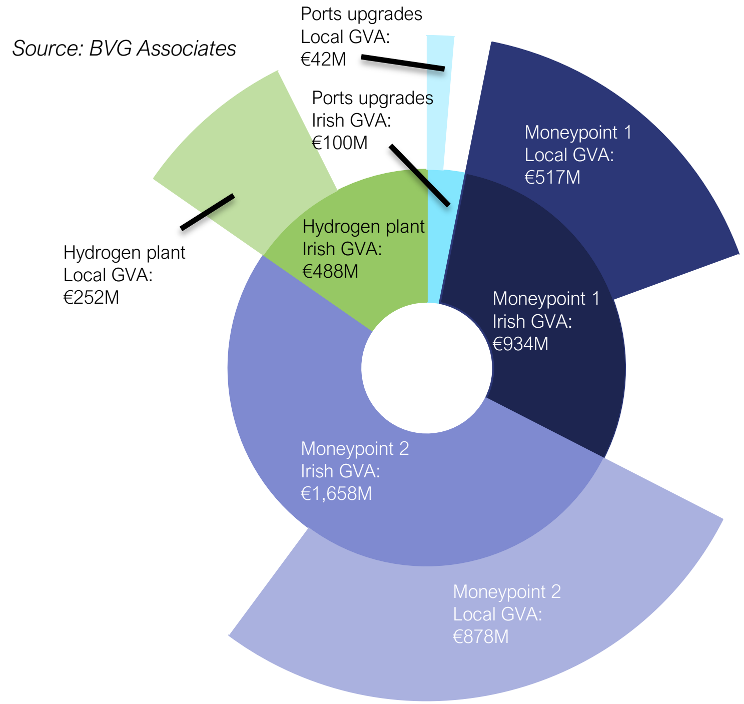

Figure 4 Local and Irish GVA by project phase - concrete foundation scenario

The breakdown of jobs from Moneypoint 2 split into supply chain categories is shown in Figure 5. These include direct, indirect, and induced FTEs for Ireland.

- Development – For development and project management, there is an average of approximately 100 jobs over an eight-year period. These include project managers, project engineers, technical surveyors, EIA surveyors, and those involved in the consenting process.
- Turbine – No jobs associated with the supply of the turbines, as all components are assumed to be imported.
- Balance of plant – Job numbers in this category are responsible for the large spikes during 2032-33 in Figure 5. Almost all the jobs created here are from the construction of the floaters. This includes the workers in forgeries across Ireland for the steel foundations, and those in the quarries for the concrete scenario. Across Ireland, approximately 2,640 FTEs per year will result from the construction of steel foundations, and around 3,340 for the concrete option.
- Installation – Installation FTEs for Ireland come from the installation of the turbines, foundations, onshore substation, and onshore export cable. The installation of the substation and export cable account for approximately 220 FTEs over a three-year period, as this is a task that can be carried out almost entirely by Irish contractors. Installation of the turbines and foundations account for around 70 FTEs per year each.
- Operations and Maintenance – O&M will provide stable, long-term jobs in both County Clare and the rest of Ireland. Across Ireland there will be approximately 80 FTEs per year in wind farm operation, 130 in turbine maintenance and service, 40 in balance of plant maintenance, and 120 in transmission maintenance.
- Decommissioning – Across Ireland, there will be an average of approximately 250 FTEs per year over a three-year period in decommissioning. These will mostly be in towing turbine back to port, dismantling them (reverse of installation process), and the disposal/recycling of materials.

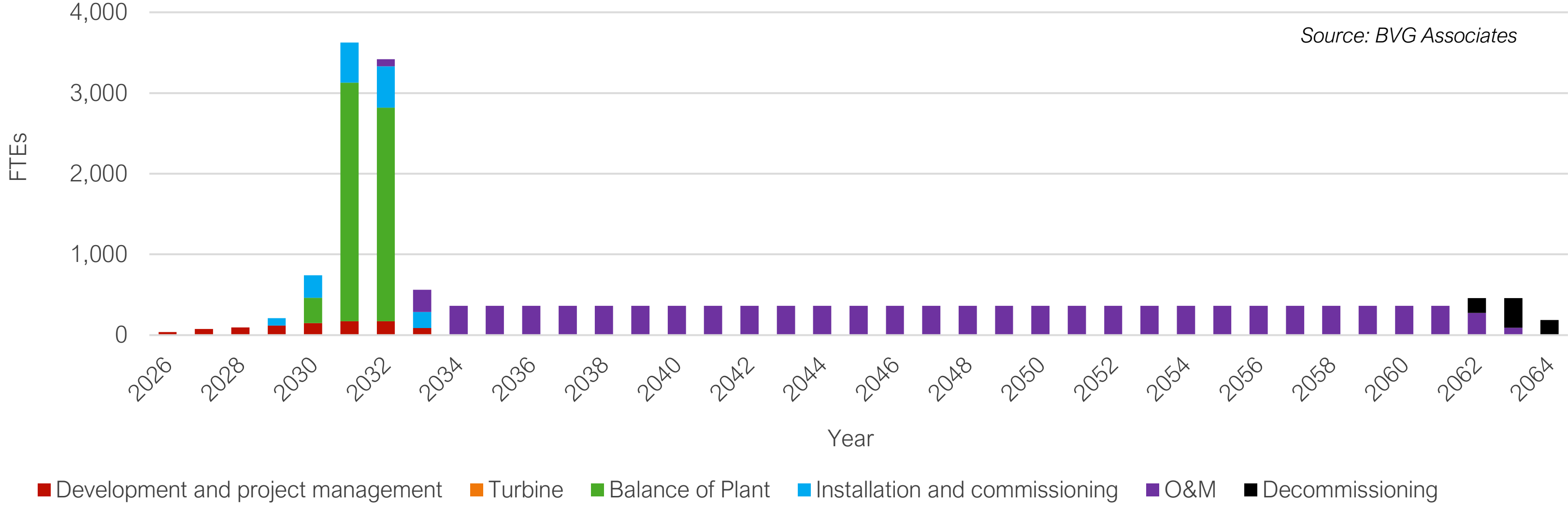

Figure 5 Irish FTEs with time by supply chain category - Moneypoint 2 steel floating foundation scenario

GVA and FTEs with time

Not all the FTE years translate into long-term jobs. A significant portion is made up from the development, construction, and installation phases of the project, which will only provide short-term work. Stable, long-term jobs come from the operations, maintenance, and servicing of the two wind farms and hydrogen plant. Figure 6 and Figure 7 show the split between short-term and long-term jobs for the steel and concrete scenario, respectively.

Values shown are the cumulative totals for all for all four phases of the project.

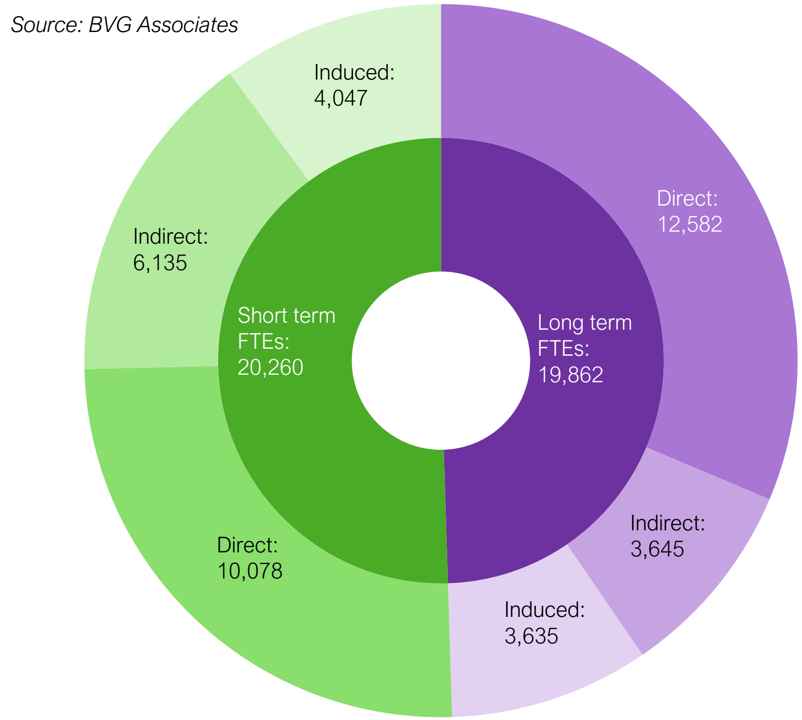

Figure 6 Short-term and long-term employment split for Ireland – steel floating foundation scenario. Values are in FTE years.

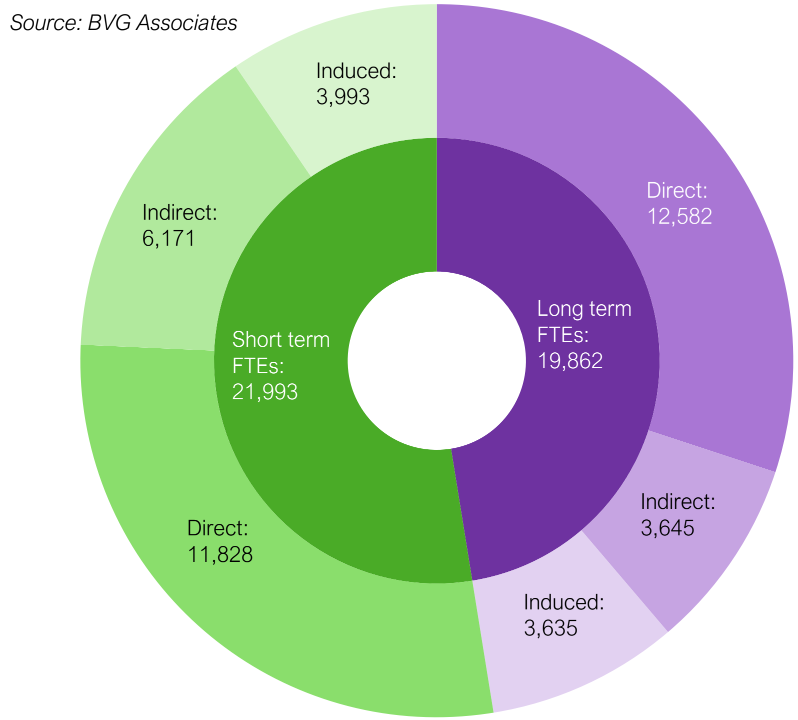

Figure 7 Short-term and long-term employment split for Ireland – concrete floating foundation scenario. Values are in FTE years.

There are the same number of long-term jobs in each scenario, as there is no significant difference in O&M between steel and concrete floaters. The 19,862 long-term FTE years come from 30 years of around 430 direct jobs, 125 indirect jobs, and 126 induced jobs. These long-term jobs are expected to last into the 2060s, when the wind farms and the hydrogen plant are likely to be decommissioned. The full time series for Irish and local jobs for the steel scenario are shown in Figure 8 and Figure 9, respectively. The concrete equivalents are shown in Figure 10 and Figure 11. The full set of time series charts for GVA/FTEs for each scenario (Irish and local, steel and concrete) are included in Appendix D.

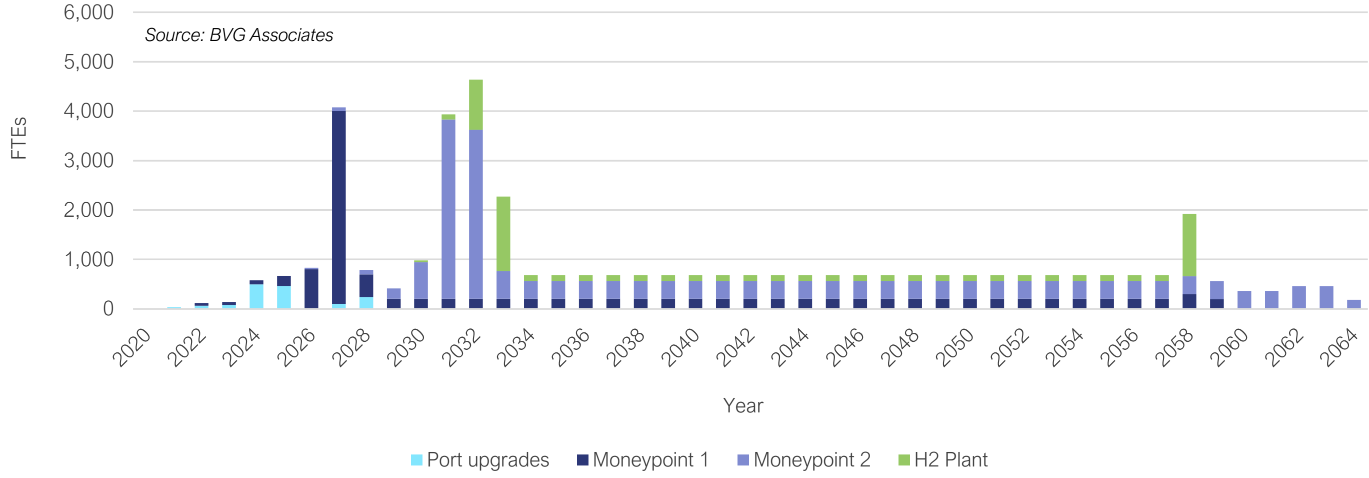

Figure 8 Irish FTEs time series for Green Atlantic @ Moneypoint projects – steel floating foundation scenario

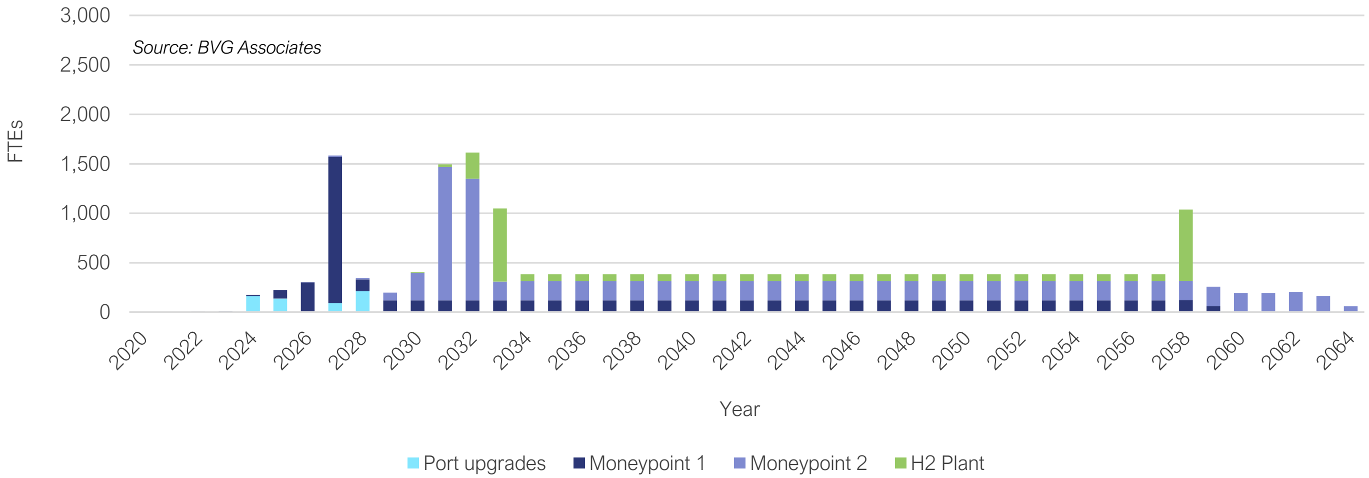

Figure 9 Local FTEs time series for Green Atlantic @ Moneypoint projects – steel floating foundation scenario

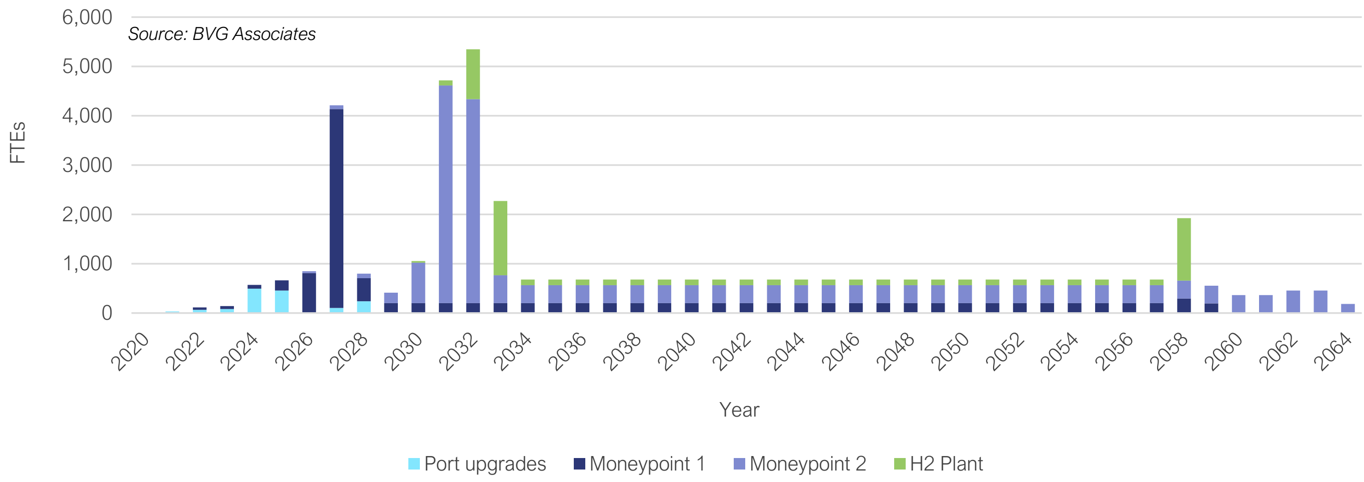

Figure 10 Irish FTEs time series for Green Atlantic @ Moneypoint projects - concrete floating foundation scenario

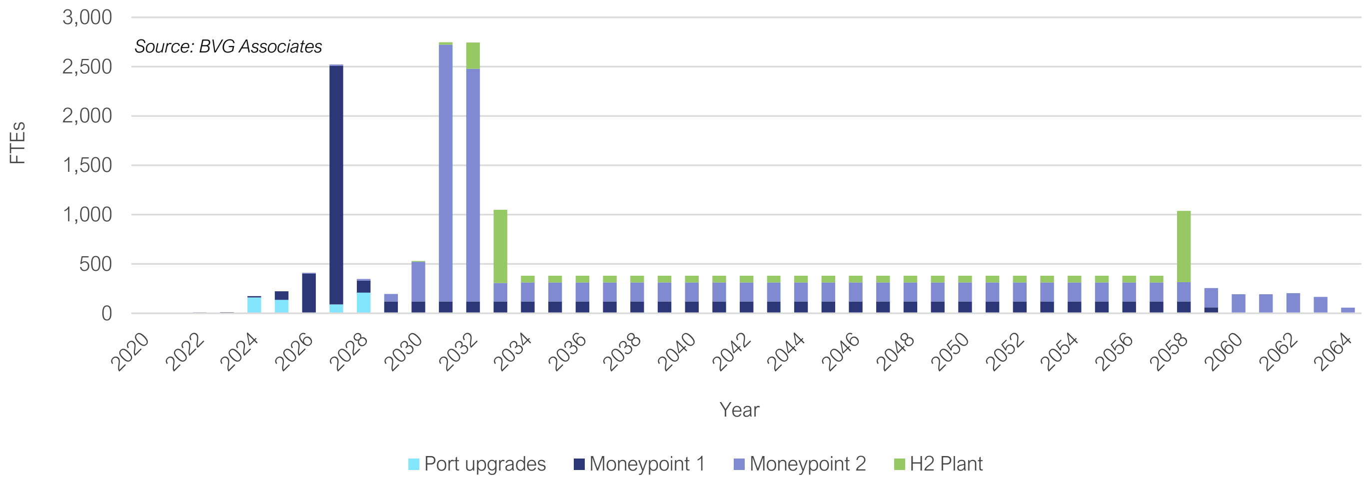

Figure 11 Local FTEs time series for Green Atlantic @ Moneypoint projects - concrete floating foundation scenario

Industry specific impacts

Contribution to decarbonisation

The two Moneypoint wind farms will result in significant carbon emission savings compared to equivalent coal power generation, totalling around 176 million tonnes of equivalent carbon dioxide (CO_2^e) emission being saved. This would be a significant step in achieving the goals of a 30% reduction in emissions by 2030, and net-zero by 2050, according to the Ireland National Energy and Climate Plan 2021-2030. The annual net carbon savings are shown in Figure 12. It should be noted that the following figures refer to windfarm construction using the steel floating foundations scenario and both steel and concrete foundation scenarios are very similar.

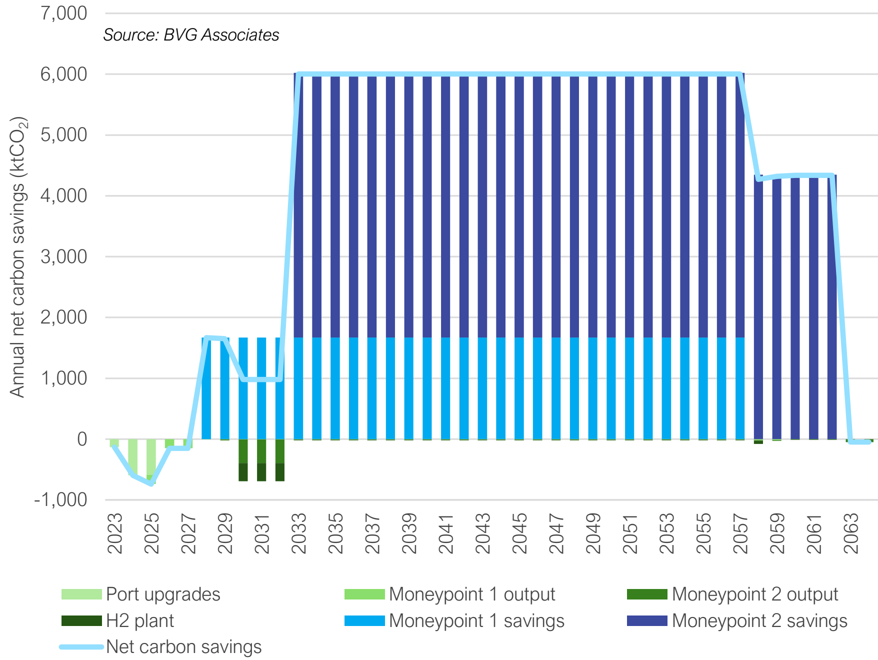

Figure 12 Annual net carbon equivalent savings

The cumulative carbon equivalent savings over the lifetime of the project are shown in Figure 13. The wind farms quickly offset the carbon expenditure of the construction process, with a payback period of just one year. By 2029, the projects savings will outweigh the carbon expenditure of the port upgrades and the construction of Moneypoint 1.

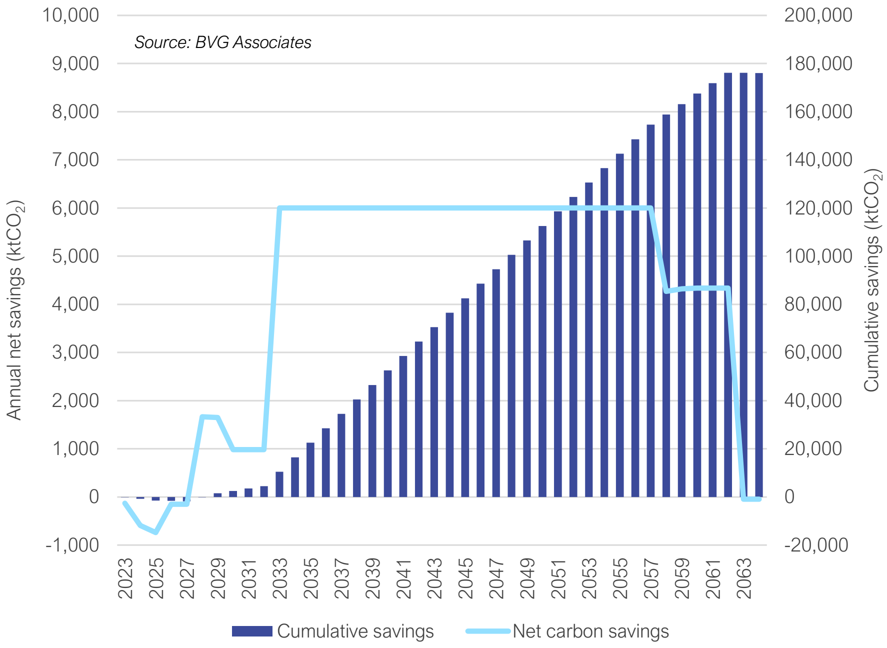

Figure 13 Cumulative carbon equivalent savings

Once both farms are in operation, they will save around 6 million tonnes of CO_2e annually, compared to that of coal generation. The annual equivalents of this are shown in Figure 14.

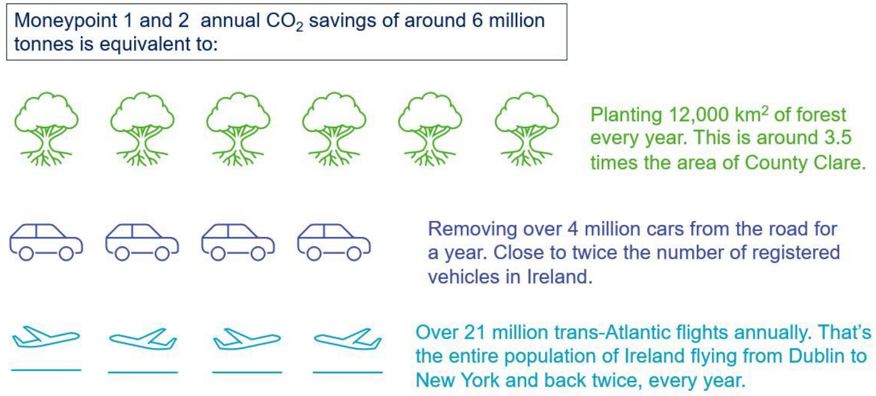

Figure 14 Annual equivalents of the carbon savings from Moneypoint 1 and 2

Impact on LCOE on west coast projects

The port upgrades at Moneypoint, and the deployment of the two winds farms, will reduce the LCOE of floating wind projects off Ireland's west coast. For the steel and concrete scenarios, the LCOE of Moneypoint 2 was calculated to be 7.9% and 5.6% lower than an equivalent wind farm without the new port facilities at Moneypoint, respectively. The main factors contributing to this change are detailed below.

From a development standpoint, there is no change in cost. The same goes for the supply of the turbines, export and array cables, and substations.

The key factors causing the differences in LCOE are:

- Foundation supply: With the new port facilities, both steel and concrete foundations will be constructed on site. Without them, we assume the foundations would be constructed in France (concrete) and Spain (steel). Turbine mating would take place at the foundation construction port and the full package would be towed to site. Substructure cost would likely be lower, as Spain has lower labour costs than Ireland, and France will likely be more efficient in the construction of concrete substructures initially through experience. The transportation and installation costs will be increased.

- Installation: The new facilities at Moneypoint will allow for the storage of foundations and turbines, and for the mating of turbines to foundations. Without such regional facilities in proximity to the wind developments, it would likely be necessary to tow the fully assembled turbines from other facilities in the UK or European mainland (such as France or Spain) to the windfarm site. This makes working around weather windows challenging, especially given that the approximately five-day transportation time means additional uncertainty in conditions between leaving port in France or Spain and arriving at site. Conditions on site are already harsh, as there is nothing but ocean to the west to shelter the site from strong winds and large waves. Having the assembly port at Moneypoint will allow the installation team to react more quickly to these weather windows and reduce downtime. The same is true for the installation of the mooring systems, array cables, and export cables. It will also allow for all aspects of assembly and installation to be overseen by the same personnel, improving consistency and efficiency.
- Operations and maintenance: The new Moneypoint facilities will provide further cost reductions in O&M activities. As for installation, the harsh weather conditions off Ireland's west coast will be problematic for maintenance procedures, particularly unplanned ones. Like installation, having an O&M base at the new Moneypoint facility will allow for a faster response to unplanned maintenance, meaning less downtime due to severe conditions, and a higher energy yield, lowering LCOE. The port also provides a sheltered, deep-water area for turbines to be towed back to for major repair works – something that is vital for the maintenance of floating turbines.

Contribution to the success of floating wind projects

The investment in a local construction/assembly port may be necessary for Ireland to develop a floating offshore wind industry. The main reasons are as follows:

- It may be unfeasible to tow floating substructures from the UK or Europe to Irish west coast offshore sites. With an expected installation window of just three months due to the difficult metocean conditions off Ireland's west coast, installation would be difficult and expensive.
- A local construction/assembly port would make a significant contribution to lowering the cost of energy. If Ireland is to reach its offshore capacity goals, minimising LCOE is an important step. Further reductions in LCOE are likely beyond the two projects considered, as the local and Irish supply chains develop, and efficiency improves through learning.
- Investing in a local construction port will improve community buy-in to offshore wind. Providing community benefits through bolstering the economy and creating long-term jobs will get the public behind the country's offshore wind goals.
- Ireland has expressed intent to capture an estimated 30GW of offshore floating wind potential in the Atlantic Ocean. While floating substructures can possibly be imported for early projects this will not be practical in the long run, meaning that local construction ports will be almost inevitable.
- It is likely that floating turbines will need to be towed into port for major maintenance works. Site water depths are too great for jack-ups to operate, and heavy-lift vessels may not provide the stability needed for high-elevation maintenance. Moneypoint provides a deep-water port where turbines can be worked on safely.

Qualitative socio-economic impacts

A qualitative assessment of the project's impact on socio-economic factors beyond the modelling presented above is shown in Table 4.

Table 4 Impact on socio-economic factors

Factor	Impact	Comments
Tourism	Neutral	Tourism is one of Ireland's most important economic sectors, especially for more rural areas and smaller towns. According to 'County Clare Tourism Strategy 2030', the industry generated €244 million in 2018 provides roughly 6,600 jobs[1]. There is conflicting evidence as to the exact effect offshore wind farms have on tourism, but several studies show that farms beyond 12km from shore are unlikely to have a significant impact[2,3]. There are opportunities for boat tours to the farms, but overall, County Clare's tourism industry is unlikely to be affected by the project.
Population and demographics	Neutral/Positive	There is likely to be some migration of skilled labour to the local area with approximately 400 local long-term jobs opening. While this likely will not impact the population of County Clare as a whole, smaller towns in the surrounding area could see an influx in population with the addition of new, stable employment and economic growth.
Land use	Neutral	The project should have no direct impact on land use, as the wind farms are offshore, and the hydrogen plant and port upgrades are all within the footprint of the current Moneypoint site. It can be argued that there is an indirect impact, as the deployment of offshore wind lessens the need for onshore energy generating alternatives to meet renewable goals.
Income and employment	Positive	The project is likely to have a positive impact on average income, as jobs in offshore wind are well-paid on average, and higher than the current average wage in County Clare. From the CSO, average income in the area in 2019 was around €40k/yr[4], while we expect the long-term O&M jobs to pay around €50k/yr. There will also be a positive impact on employment levels. From the economic analysis, the project will create many long-term jobs. The newly created jobs will outnumber the current job numbers at the Moneypoint coal plant (currently under 100 employees), meaning a net positive for employment levels. The wind farms and hydrogen plant will open diverse job opportunities not currently available in the area. These include wind farm operators, turbine technicians, and H_2 plant operators.

[1] County Clare Tourism Strategy 2030, County Clare Council, https://www.yumpu.com/en/document/read/65325108/county-clare-tourism-strategy-2030, accessed August 2021

[2] Westerberg, Jacobsen, Lifran, 'The case for offshore wind farms, artificial reefs and sustainable tourism in the French Mediterranean', *Tourism Management 67*, 2013

[3] Tourism and offshore wind, European MSP Platform, https://www.msp-platform.eu/sector-information/tourism-and-offshore-wind, accessed August 2021

[4] Earnings and labour costs annual 2019, Central Statistics Office, 2020, https://www.cso.ie/en/releasesandpublications/er/elca/earningsandlabourcostsannualdata2019

Factor	Impact	Comments
		Economic activity will see an increase, as the project will generate direct and indirect GVA through local and Irish expenditure. This in turn will create further induced GVA.
Community	Neutral/Positive	Community includes factors such as crime rates, deprivation, and life expectancy. Studies have linked an increase in economic activity to a reduction in crime rates[5]. As more legal paths to earning income open, the need for crime decreases. Similarly, there could be a slight positive impact on deprivation rates. Although the west of Ireland has some of the lowest deprivation rates in the country (according to the most recent statistics form the CSO), the increase in economic activity could see this number further reduced. Life expectancy could also see a small positive impact for two main reasons. Replacing fossil fuel generation such as coal with renewables will result in a reduction in air pollution. The health benefits of this are included in Ireland's 'National Energy and Climate Plan 2021/2030'[6]. Life expectancy can also be positively impacted by the general increase in average income/economic activity, as the link between these is well established[7]. It should be noted that these factors would be affected only slightly for a project of this scale.
Education	Positive	Offshore wind requires skilled workers across a range of areas, including project management, asset management, engineering, technicians, and surveying. If Moneypoint were to deploy turbines annually, long-term jobs would open up in these areas. As part of Ireland's 'National Energy and Climate Plan 2021/2030'[6], enhancing the local and national education and training system is an important step in decarbonisation, including upskilling and re-training workers to fill skilled positions in renewables. As such, Moneypoint 1 and 2, and the hydrogen plant, could have a positive impact on the local area via a more varied skill base, more education opportunities, and a general higher average qualification level.
Transportation and other infrastructure	Neutral	There is unlikely to be significant impacts in these areas, but there is the potential for road improvements. These may be required for the high volume of heavy loads being delivered to the Moneypoint port.

[5] Brittany Street, The Impact of Economic Activity on Criminal Behavior: Evidence from the Fracking Boom, 2019

[6] National Energy and Climate Plan 2021-2030, Department of Communications, Climate Action & Environment, 2020

[7] Chetty at al, The Association Between Income and Life Expectancy in the United States 2001–2014, JAMA Volume 316, 2016

Factor	Impact	Comments
Housing	Neutral/Positive	House prices increasing with average income is a well-established relationship, as a 1% increase in average income typically corresponds to a 2% increase in house prices[8]. With the local area likely to see an increase in average income, house prices are also likely to increase. Whether this can be considered positive or negative is a matter of perspective, but an increase in the house market is typically an indicator of a growing economy.
Business	Positive	As per the economic analysis, the project will generate substantial GVA and FTEs which, in turn, generate induced GVA and FTEs. This induced GVA means new business opportunities and also opportunities for existing local businesses to grow. A positive impact could also be seen in local industry. For example, the continual deployment of offshore wind will allow for industries in the supply chain to develop, such as the currently limited heavy steel industry.

[8] Analysis of the determinants of house price changes, Ministry of Housing, Communities & Local Government, 2018

4. Outlook to 2050 and beyond

It is envisaged that the new Moneypoint port facilities will be used on an ongoing basis in the decades to come to enable the continued deployment of additional floating windfarms in the Atlantic, some of which are already in the early stages of development by both Irish and international developers.

The previous section considered the construction and installation of the Moneypoint 1 and 2 floating offshore wind sites only. This meant that a high proportion of the jobs supported during the construction phase were lost once operations commenced. With Ireland having an ambition of 35GW offshore wind by 2050, and with around 30GW of that expected to be floating projects primarily off the south and west coasts, it is prudent to consider the potential impact of such a construction pipeline beyond Moneypoint 2.

Maintaining the assumption that Moneypoint can support the construction of around 500MW of floating wind in any one year, over a period of 20 years (2034 to 2053) this would mean a further 10GW being supported. A total of 11.4GW of floating offshore wind deployed out of Moneypoint alone by 2053 is a significant but not unreasonable fraction of the 30GW expected around the south and west coasts.

A strong market growth scenario will encourage more developments in the supply chain, as suppliers can have more confidence that they will get a return on their investment. In this section we consider the effects of this constant pipeline on the expected GVA and FTE values.

The possibility of expanding the hydrogen plant by 1-2GW to help accommodate the growing offshore market was briefly considered. It was agreed, however, that the initial 1GW hydrogen plant would occupy the available space, so further expansion was not included in this analysis.

Supply chain narrative

For much of the supply chain, content splits are the same as they were for the analysis of the Moneypoint 1 and Moneypoint 2 wind farms in Section 3. Any changes to these assumptions, as well as how they evolve over time through to 2053, are detailed in this section. Local and Irish content numbers are given in 5-year intervals.

The supply chain narrative works under the assumption that Ireland will not introduce any local content restrictions.

Development

There are no major breakthroughs expected in the local supply chain, or in the rest of Ireland. Incremental developments are possible (more local surveying, technical consultation, etc) as the market grows, but it is likely that these will continue to be procured from other European markets. These markets are more mature, and the Irish market is not large enough to drive new investment in this area.

The local and Irish content from development for both steel and concrete foundation scenarios is shown in Table 5.

Table 5 Local and Irish development content

	2034-‘38	2039-‘43	2044-‘48	2049-53
Local content	23%	23%	23%	23%
Rest of Ireland content	40%	40%	40%	40%

Turbine

The only major development being considered in the supply chain is with the turbine, with the assumption that a tower factory will be built somewhere in Ireland (assumed not County Clare) by 2034 at the latest. With 500MW being deployed from Moneypoint annually, it can be assumed that at least 1.5GW will be deployed annually across Ireland. This is considered sufficient volume to support a tower factory, particularly since towers are difficult to transport over long distances and a local solution will be sought where possible. Despite being a significant cost, sourcing towers locally brings relatively low benefits in comparison, as the steel plates and rolling machines (e.g. Faccin in Italy) will be purchased from international suppliers. This results in only around 30% of total tower cost being Irish content.

Other turbine components, such as blades or nacelles, do not have the volume to support a local factory. Unlike towers, which can be universally used with any make of turbine, blades and nacelles will be split between several turbine OEMs. It is unlikely the any manufacturers individual market share will be sufficient to justify a dedicated factory in Ireland.

The local and Irish content from the turbine for both steel and concrete foundation scenarios is shown in Table 6.

Table 6 Local and Irish turbine content

	2034-'38	2039-'43	2044-'48	2049-53
Local content	0%	0%	0%	0%
Rest of Ireland content	3%	3%	3%	3%

Balance of plant

The majority of local/Irish content from balance of plant comes from the manufacture of the floating foundations. It is not expected that any additional content would be brought in locally/nationally for either concrete or steel foundations over time. Overall content for the foundations will lower slightly with time, as the local manufacturing becomes more efficient and therefore a smaller proportion of the cost. This will be most noticeable with the concrete floaters, where labour accounts for a larger portion of cost.

The content coming from the remainder of the balance of plant will be the same as it was for Moneypoint 1 and 2 wind farms. The market will not be large enough to justify an offshore substation construction port. Subsea cables can be easily transported so there is no need for a manufacturer to invest in a new plant – it is typically more economical for them to expand an existing plant.

The local and Irish content percentages from balance of plant for both steel and concrete foundation scenarios are shown in Table 7 and Table 8, respectively.

Table 7 Local and rest of Ireland balance of plant content - steel foundation scenario

Steel foundation scenario	2034-'38	2039-'43	2044-'48	2049-53
Local content	11%	9%	9%	8%
Rest of Ireland content	17%	17%	16%	16%

Table 8 Local and rest of Ireland balance of plant content - concrete foundation scenario

Concrete foundation scenario	2034-'38	2039-'43	2044-'48	2049-53
Local content	26%	23%	22%	21%
Rest of Ireland content	15%	15%	15%	14%

Installation and commissioning

There are no major changes to local/Irish content in installation and commissioning. It is unlikely that Ireland will have specialist installation vessels of its own such as cable lay vessels or subsea drilling vessels for mooring installation. The assumption that Irish anchor handling tugs will be used for towing the turbines to site remains unchanged.

The local and Irish content from installation for both steel and concrete foundation scenarios is shown in Table 9.

Table 9 Local and rest of Ireland installation content

	2034-'38	2039-'43	2044-'48	2049-53
Local content	15%	15%	15%	15%
Rest of Ireland content	28%	28%	28%	28%

Operation, maintenance and service

For the 10GW that will be deployed, it has been assumed that 5GW will be serviced locally, likely from the Moneypoint port. The remaining 5GW will be serviced elsewhere on the Irish west coast. This results in content being shifted from local sources to the rest of Ireland.

It is likely that some smaller services will be subcontracted to local/Irish contractors as the market grows and suppliers emerge. We have assumed that more spare parts management will occur locally. Across Ireland, we have assumed that as the offshore market grows, more operators will establish control centres and run their asset management from within the country. It has also been assumed that some additional activities in blade inspection and maintenance will be sourced from around Ireland, along with some maintenance and servicing of vessels.

The local and Irish content from OMS for both steel and concrete foundation scenarios is shown in Table 10.

Table 10 Local and rest of Ireland OMS content

	2034-'38	2039-'43	2044-'48	2049-53
Local content	15%	15%	15%	16%
Rest of Ireland content	37%	40%	44%	44%

Decommissioning

The local and Irish content from the decommissioning phase is unchanged from the Moneypoint 1 and 2 analysis. It was still assumed that Irish tugs will tow the turbines back to port at end-of-life for disassembly, and the disposal/recycling of materials being done locally and across the rest of Ireland. Specialist vessels will still be required for decommissioning of cables, substations, and mooring systems, which Ireland is unlikely to provide.

The local and Irish content from decommissioning for both steel and concrete foundation scenarios is shown in Table 11.

Table 11 Local and rest of Ireland decommissioning content

	2034-'38	2039-'43	2044-'48	2049-53
Local content	18%	18%	18%	18%
Rest of Ireland content	35%	35%	35%	35%

Economic analysis

In this section, the economic benefits (in terms of GVA and FTEs) of the annual deployment of 500MW from the Moneypoint facilities are presented. The results are presented with a focus on annual number of jobs rather than the total over the 20 year period. While the results have been modelled for 20 years of continuous deployment, the economic benefits will likely continue beyond this mark, as Ireland essentially repowers/replaces end-of-life wind farms to maintain their offshore capacity (assuming Ireland does not require significantly more capacity than the 35-40GW assumed in this analysis).

Total GVA and FTEs

The total 10GW of deployed capacity will generate around €13.5b in GVA for Ireland in the steel foundation scenario (26% local) and €14.4b in the concrete scenario (32% local). This translates to around 170k and 187k FTEs for the two scenarios, respectively. The breakdown for direct, indirect, and induced GVA/FTEs is shown in Table 12.

Table 12 Direct, indirect, and induced GVA/FTEs for full 10GW deployment

		GVA (€b)	FTEs ('000s)
Steel foundation scenario	Direct	7.3	90.3
	Indirect	3.8	45.5
	Induced	2.4	34.2
Concrete foundation scenario	Direct	8.0	103.0
	Indirect	4.0	48.0
	Induced	2.4	35.7

Each 500MW deployment will contribute an average of €0.68b and €0.72b in GVA for the steel and concrete foundation scenarios, respectively, and 8,500 and 9,300 FTEs. This is just an average, as both GVA and FTEs will reduce gradually with time as the market matures, processes become more efficient, and costs are reduced. While overall local content increases, it is not enough of an increase to outweigh the reduction in costs.

FTE profiles with time

Construction

As with the analysis of the Moneypoint 1 and 2 wind farms, balance of plant contributes to most of the construction jobs. This is primarily due the construction of the floaters. This is also the area that sees the most reduction over time, as the local manufacture is expected to be somewhat inefficient initially, leaving space for improvements in learning and reduction in costs.

For the steel foundation scenario, annual Irish FTEs are around 3,900 in 2034, and around 2,800 in 2050 (29% reduction). Annual local FTEs are around 1,200 in 2034, and around 800 in 2050.

For the concrete foundation scenario, annual Irish FTEs are around 4,900 in 2034, and around 3,500 in 2050 (28% reduction). Annual local FTEs are around 2,500 in 2034, and around 1,600 in 2050.

These numbers included direct, indirect, and induced FTEs.

Figures and charts are given to 2050 rather than 2053. Due to the nature in which the economic benefits are modelled, costs in each area for a single 500MW deployment are spread over several years. Since the modelling stopped at 2053, annual FTEs begin to taper off and eventually reduce to zero. In reality, additional projects will likely be deployed beyond 2053, at the very least to replace old farms that are being decommissioned. This would mean construction jobs will be available beyond 2053. Charts for construction FTEs are therefore only given to 2050, to hide this tapering off and not misrepresent the FTEs beyond 2050.

Figure 15 and Figure 16 show the Irish and local construction FTEs for the steel foundation scenario. The equivalent figures for the concrete foundation scenario are shown in Figure 21 and Figure 22 in Appendix E.

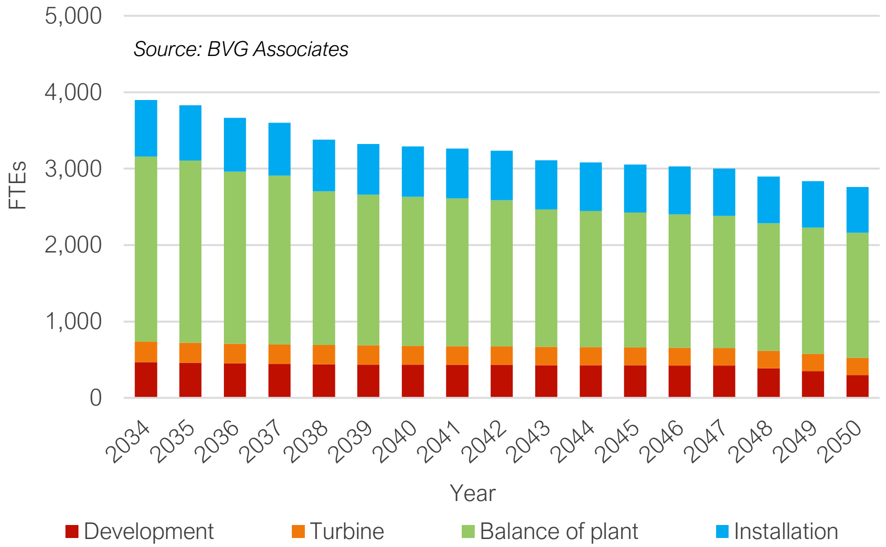

Figure 15 Irish FTEs from construction phase - steel scenario

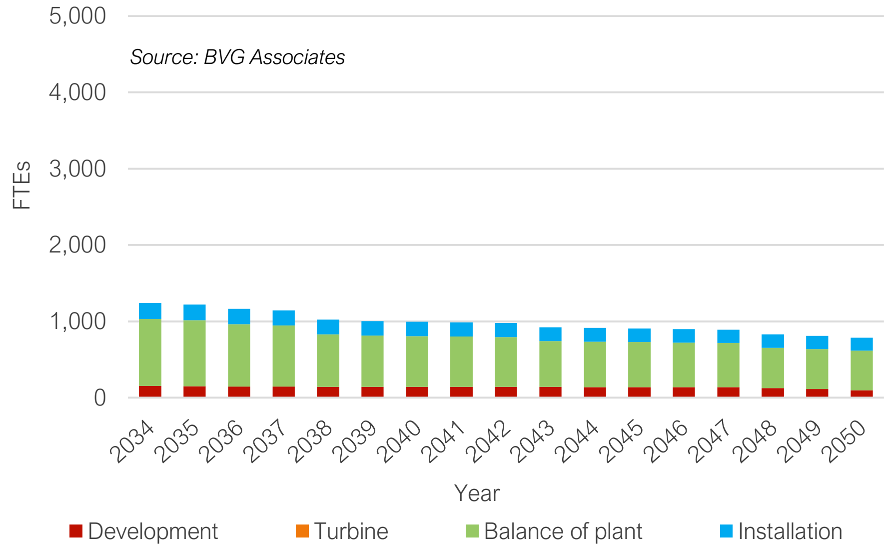

Figure 16 Local FTEs from construction phase - steel scenario

Operations, maintenance, and service

Unlike with the construction jobs which remain somewhat steady, OMS jobs accumulate as more wind farms are deployed. New jobs per annual 500MW deployment decrease over time as OMS processes become more efficient and costs decrease, resulting in the cumulative jobs growing at slower rate with time. Across Ireland, around 180 new OMS jobs will be created per year at the beginning of the period, reducing to around 150 per year by 2053, resulting in a total of around 3,250 cumulative jobs over the 20 years. These numbers included direct, indirect, and induced FTEs.

The OMS jobs beyond 2053 are dependent on where the Irish offshore market goes. If no further growth is seen, OMS jobs should remain steady. If it continues to grow, more OMS jobs will accumulate.

Figure 17 and Figure 18 show the Irish and local FTEs from the OMS phase. They are presented as both the new, annual jobs that arise from each 500MW that is deployed, and the cumulative jobs. Both steel and concrete scenarios were modelled to have the same OMS costs. If one foundation type was expected to be notably lower cost than the other, then there would be no reason to consider both. It therefore has to be assumed that they will have similar costs at this point in time.

The job numbers presented in this section are only for the 20 years of 500MW deployment. They do not include the OMS jobs that will be created from the Moneypoint 1 and 2 wind farms or the hydrogen plant.

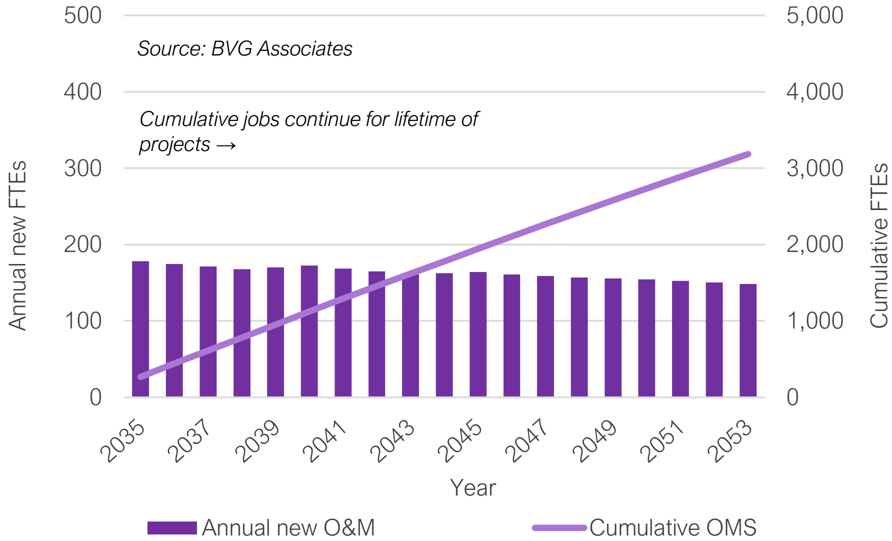

Figure 17 Irish FTEs from OMS phase

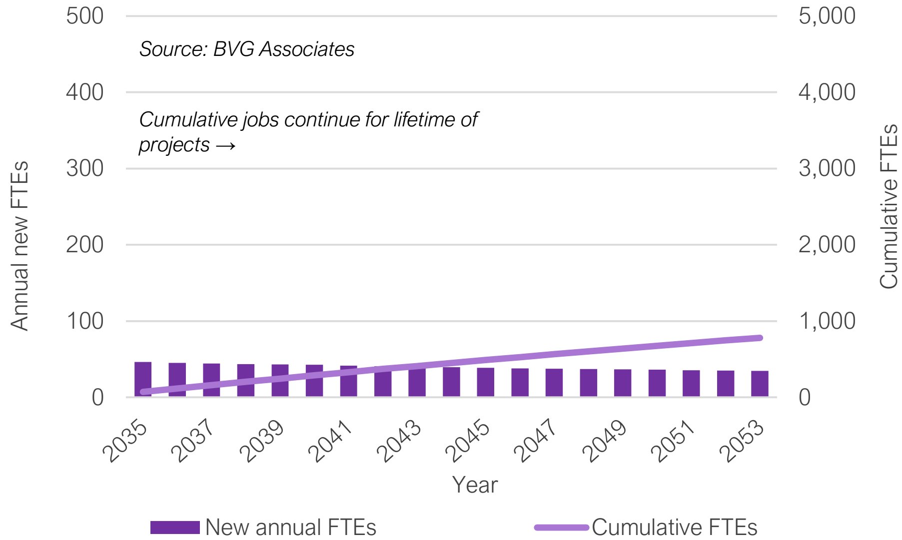

Figure 18 Local FTEs from OMS phase

Decommissioning

Decommissioning jobs from this 10GW of deployment will not come about until around the mid-2060s. As with construction and OMS phases, jobs decrease with time as the process becomes more efficient and costs decrease.

The Irish and local FTEs from the decommissioning phase are shown in Figure 19 and Figure 20. As above, costs were modelled the same for both foundation type scenarios.

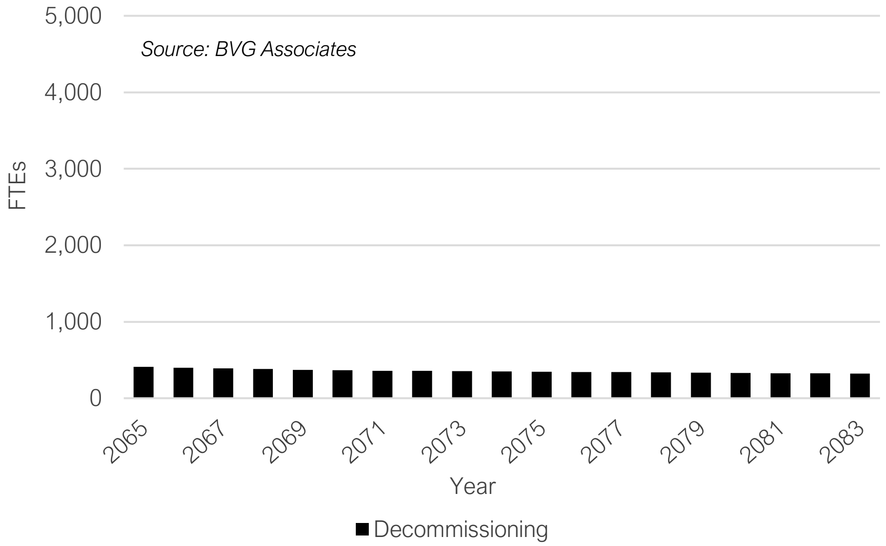

Figure 19 Irish FTEs from decommissioning phase

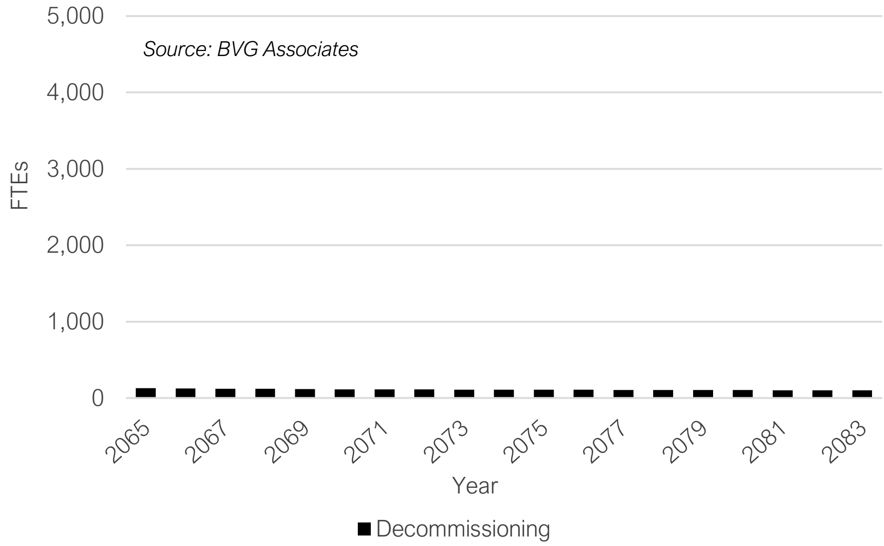

Figure 20 Local FTEs from decommissioning phase

Summary

In section 3, we have assessed the socio-economic impact of four proposed phases of development of ESB's Moneypoint facility on the Shannon estuary in County Clare, Ireland. The four phases were:

1. Port upgrades
2. Moneypoint 1 floating wind farm (400MW)
3. Moneypoint 2 floating wind farm (1,000MW), and
4. a hydrogen plant (1GW).

We have calculated that the total Irish GVA for all four phases was between €3.08 billion and €3.18 billion, depending on whether the wind farms use steel or concrete floaters. This translates to between 40,112 and 41,855 FTE years over the lifetime of the projects.

We have established that a local deep water port facility in Ireland is likely to reduce the overall LCOE of floating wind in Irish waters by between 5.6 to 7.9%. We believe that such port facilities will be an essential step if Ireland's overall ambitions of 30GW of offshore floating wind in the Atlantic are to be achieved in the long term.

We have further provided a qualitative review of other social areas that may be affected by the proposed developments. This covered the following:

- Tourism
- Population and demographics – population, growth, density, migration levels
- Land use – designated land use types
- Income and employment – household income, employment levels, occupations, economic activity level
- Community – deprivation, crime, life expectancy
- Education – skills base, education, qualification level, technical colleges, universities, engineering competence
- Transportation and other infrastructure – access to public transport, commuting trends, broadband connectivity.
- Housing – prices, stock, tenure (rent or owned), and
- Business - sectors and local industry.

Finally, in section 4, we have evaluated the economic benefits of a further 20 years of floating wind deployment out of Moneypoint. The total GVA from deploying 500MW every year between 2034 and 2053 was calculated to be €13.5b and €14.5b for steel and concrete foundation scenarios, respectively. This averages as €0.68b and €0.72b per year (or per 500MW) for each scenario.

Total FTEs were calculated to be 170k and 187k for the steel and concrete scenarios, respectively. This averages as 8,500 and 9,300 per year (or per 500MW) for each scenario. These numbers are additional to jobs created by the port upgrades, Moneypoint 1 and 2 farms, and hydrogen plant.

High level recommendations

Some high-level recommendations based on this analysis are provided below:

- Further investigation into the feasibility of concrete floaters. Industry engagement has suggested that concrete floaters may be too impractical due to their incredibly large masses. Potential installation, mooring, and O&M issues could make them an unfavourable option from a technical perspective.
- Communicate the benefits of Green Atlantic @ Moneypoint to the local community and Ireland as a whole: The Irish government have expressed their intent to deploy 5GW of offshore wind by 2030, and potentially capture 30GW of offshore floating capacity in the Atlantic in order to reach net-zero. This could require significant investment, and communicating the economic benefits, in the form of long-term jobs and economic growth, of Green Atlantic @ Moneypoint will increase public backing.
- Commission further studies to further evaluate the full extent of the impact of the project. This includes stakeholder engagement, cost-benefit analysis,

and other feasibility studies. It is important to properly evaluate all the impacts of a project of this size before committing to investment.

Appendix A Project timeline

Table 13 Expected timeline for all phases of project (O&M and decommissioning not shown)

		‘21	‘22	‘23	‘24	‘25	‘26	‘27	‘28	‘29	‘30	‘31	‘32	‘33	‘34
Port upgrades	Development		■	■											
	Construction				■	■									
	Coal plant decommissioning									■	■				
Moneypoint 1	Development			■	■	■	■								
	Construction					■	■	■							
	Installation						■	■							
Moneypoint 2	Development								■	■	■	■			
	Construction										■	■	■		
	Installation											■	■		
Hydrogen plant	Development										■	■	■		
	Construction												■	■	
	Installation												■	■	

Appendix B Economic impacts method

Conventional modeling of economic impacts for most industrial sectors relies on government statistics, for example those based on European industrial activity classification (NACE) codes and use input-output tables and other production and employment ratios, for example those produced by the Central Statistics Office of Ireland. NACE code data can be appropriate for traditional industries at a national level. The development of new codes for a maturing sector, however, takes time. This means that conventional NACE analyses of offshore wind need to map existing NACE data onto offshore wind activities, which is not easy and a source of error. Analyses using NACE codes also rely on generalised data.

Offshore wind requires a more robust approach that considers current and future capability of local supply chains because:

- Projects tend be large and have distinct procurement processes, and
- Projects tend to use comparable technologies and share supply chains.

An offshore wind specific approach therefore enables a realistic analysis of the local and national content of projects, even if the data is incomplete.

In a conventional NACE-based analysis, successful contractors are categorized using NACE. Input-output tables created, for example, by the Central Statistics Office are then used to develop multipliers. These multipliers attempt to calculate how demand in each of the NACE sectors leads to direct, indirect and induced impacts. The multipliers used in conventional analysis ignore the specific offshore wind supply chain characteristics.

The BVGA method is based on the offshore wind UK content methodology. It uses understanding of the supply chain in the lower tiers to produce a figure that is equivalent to direct and indirect GVA. Calculating a local and national content figure, and understanding profit margins, costs of employment and salaries enables direct and indirect FTEs to be calculated. Induced impacts are calculated using conventional multipliers. The same methodology is followed for local content.

The remaining expenditure is analogous to the direct and indirect GVA created. GVA is the aggregate of labor costs and operational profits. We can therefore model FTE years from GVA, provided we understand some key variables. In our economic impact methodology, employment impacts are calculated using the following equation:

$$FTE_a = \frac{(GVA - M)}{Y_a + W_a}$$

Where:

FTE_a = Annual FTE employment

GVA = Gross value added (€)

M = Total operating margin (€)

Y_a = Average annual wage (€), and

W_a = Non-wage average annual cost of employment (€).

To make robust assessments, therefore, we considered each major component in the offshore wind supply chain and typical salary levels, costs of employment and profit margins, bringing together BVGA's specific sector knowledge and research into typical labor costs for the work undertaken in each part of the supply chain.

Appendix C Supply chain narrative for port upgrades, Moneypoint 1 and 2 wind farms, and H2 plant

Table 14 Port upgrades expenditure and content splits

Area	Activity	Cost (€k)	Source	% of activity
Quay upgrades	Prelims, admin, insurance, 15%	8,910	Local	0%
			Rest of Ireland	90%
			International	10%
	Site preparation	385	Local	20%
			Rest of Ireland	56%
			International	24%
	Piling works	26,400	Local	20%
			Rest of Ireland	56%
			International	24%
	Reclamation works	15,730	Local	20%
			Rest of Ireland	56%
			International	24%
	Concrete works	16,500	Local	20%
			Rest of Ireland	56%
			International	24%
	Quay furniture and services	957	Local	20%
			Rest of Ireland	56%
			International	24%
Landside upgrades	Prelims, admin, insurance, 15%	1,633	Local	90%
			Rest of Ireland	0%
			International	10%
	Mob/demob excavation plant	55	Local	65%
			Rest of Ireland	11%
			International	24%

Area	Activity	Cost (€k)	Source	% of activity
	Site levelling, cut and fill	2,475	Local	65%
			Rest of Ireland	11%
			International	24%
	Ground improvement works for ash storage area	152	Local	65%
			Rest of Ireland	11%
			International	24%
	Rerouting of existing access road	1,822	Local	65%
			Rest of Ireland	11%
			International	24%
	Surfacing	6,380	Local	65%
			Rest of Ireland	11%
			International	24%
	Relocation of two onshore turbines	2,000	Local	5%
			Rest of Ireland	45%
			International	50%
Coal plant	Decommissioning of coal plant (2030)	43,000	Local	45%
			Rest of Ireland	5%
			International	50%

Table 15 Moneypoint 1 expenditure and content splits

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
Development and project management	Developing and permitting	90	Local	23%
			Rest of Ireland	40%
			International	37%
	Project management	67	Local	23%
			Rest of Ireland	40%
			International	37%
Turbine	Rotor	686	Local	0%
			Rest of Ireland	0%

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
			International	100%
	Nacelle	338	Local	0%
			Rest of Ireland	0%
			International	100%
	Tower	187	Local	0%
			Rest of Ireland	0%
			International	100%
Balance of plant	Foundation supply (steel)	1,013	Local	20%
			Rest of Ireland	27%
			International	53%
	Foundation supply (concrete)	817	Local	42%
			Rest of Ireland	20%
			International	38%
	Array cable supply	47	Local	0%
			Rest of Ireland	5%
			International	95%
	Export cable supply	60	Local	0%
			Rest of Ireland	0%
			International	100%
	Onshore and offshore substation supply	227	Local	0%
			Rest of Ireland	1%
			International	99%
	Operational infrastructure	36	Local	40%
			Rest of Ireland	30%
			International	30%
Installation and commissioning	Turbine installation	22	Local	20%
			Rest of Ireland	40%
			International	40%
	Foundation installation	35	Local	10%

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
			Rest of Ireland	40%
			International	50%
	Array cable installation	75	Local	0%
			Rest of Ireland	0%
			International	100%
	Export cable installation	26	Local	30%
			Rest of Ireland	0%
			International	70%
	Substation installation	86	Local	5%
			Rest of Ireland	55%
			International	40%
	Construction port	49	Local	50%
			Rest of Ireland	25%
			International	25%
O&M	Wind farm operation	534	Local	25%
			Rest of Ireland	25%
			International	50%
	Turbine maintenance and service	840	Local	60%
			Rest of Ireland	0%
			International	40%
	Balance of plant O&M	152	Local	40%
			Rest of Ireland	40%
			International	20%
	Transmission maintenance	470	Local	5%
			Rest of Ireland	55%
			International	40%
	Vessels	305	Local	0%
			Rest of Ireland	0%
			International	100%

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
Decommissioning	Decommissioning	139	Local	18%
			Rest of Ireland	35%
			International	47%

Table 16 Moneypoint 2 expenditure and content splits

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
Development and project management	Developing and permitting	49	Local	23%
			Rest of Ireland	40%
			International	37%
	Project management	36	Local	23%
			Rest of Ireland	40%
			International	37%
Turbine	Rotor	605	Local	0%
			Rest of Ireland	0%
			International	100%
	Nacelle	298	Local	0%
			Rest of Ireland	0%
			International	100%
	Tower	141	Local	0%
			Rest of Ireland	0%
			International	100%
Balance of plant	Foundation supply (steel)	638	Local	20%
			Rest of Ireland	27%
			International	53%
	Foundation supply (concrete)	627	Local	42%
			Rest of Ireland	20%
			International	38%
	Array cable supply	32	Local	0%
			Rest of Ireland	5%

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
			International	95%
	Export cable supply	77	Local	0%
			Rest of Ireland	0%
			International	100%
	Onshore and offshore substation supply	158	Local	0%
			Rest of Ireland	1%
			International	99%
	Operational infrastructure	-	Local	40%
			Rest of Ireland	30%
			International	30%
Installation and commissioning	Turbine installation	15	Local	20%
			Rest of Ireland	40%
			International	40%
	Foundation installation	24	Local	10%
			Rest of Ireland	40%
			International	50%
	Array cable installation	48	Local	0%
			Rest of Ireland	0%
			International	100%
	Export cable installation	22	Local	30%
			Rest of Ireland	0%
			International	70%
	Substation installation	70	Local	5%
			Rest of Ireland	55%
			International	40%
	Construction port	32	Local	50%
			Rest of Ireland	25%
			International	25%
O&M	Wind farm operation	345	Local	25%

Level 1 activity	Level 2 activity	Cost (€k/MW)	Source	% of activity
			Rest of Ireland	25%
			International	50%
	Turbine maintenance and service	543	Local	60%
			Rest of Ireland	0%
			International	40%
	Balance of plant O&M	98	Local	40%
			Rest of Ireland	40%
			International	20%
	Transmission maintenance	419	Local	5%
			Rest of Ireland	55%
			International	40%
	Vessels	197	Local	0%
			Rest of Ireland	0%
			International	100%
Decommissioning	Decommissioning	105	Local	18%
			Rest of Ireland	35%
			International	47%

BVGAssociates

Table 17 Hydrogen plant expenditure and content splits

Area	Activity	Cost (€k)	Source	% of activity
Hydrogen plant	Project development and management	23,400	Local	20%
			Rest of Ireland	60%
			International	20%
	Electrolyser system	1,620,000	Local	0%
			Rest of Ireland	0%
			International	100%
	Balance of plant	899,041	Local	0%
			Rest of Ireland	3%
			International	97%
	Export terminal	4,000	Local	0%
			Rest of Ireland	50%
			International	50%
	Installation and commissioning	105,000	Local	45%
			Rest of Ireland	35%
			International	20%
	O&M	500,000	Local	21%
			Rest of Ireland	15%
			International	64%
	Decommissioning	100,000	Local	40%
			Rest of Ireland	30%
			International	30%

Appendix D GVA and FTEs from port upgrades, Moneypoint 1 and 2 wind farms, and H2 plant

Table 18 GVA/FTEs by project phase for steel foundation scenario

Steel	Ireland		Local	
	GVA	FTE (years)	GVA	FTE (years)
Port upgrades	€100M	1,476	€42M	601
Moneypoint 1	€929M	11,988	€457M	5,662
Moneypoint 2	€1,570M	20,028	€732M	9,042
Hydrogen plant	€488M	6,630	€252M	3,371

Table 19 GVA/FTEs by project phase for concrete foundation scenario

Concrete	Ireland		Local	
	GVA	FTE (years)	GVA	FTE (years)
Port upgrades	€100M	1,476	€42M	601
Moneypoint 1	€934M	12,146	€517M	6,706
Moneypoint 2	€1,658M	21,602	€878M	11,552
Hydrogen plant	€488M	6,630	€252M	3,371

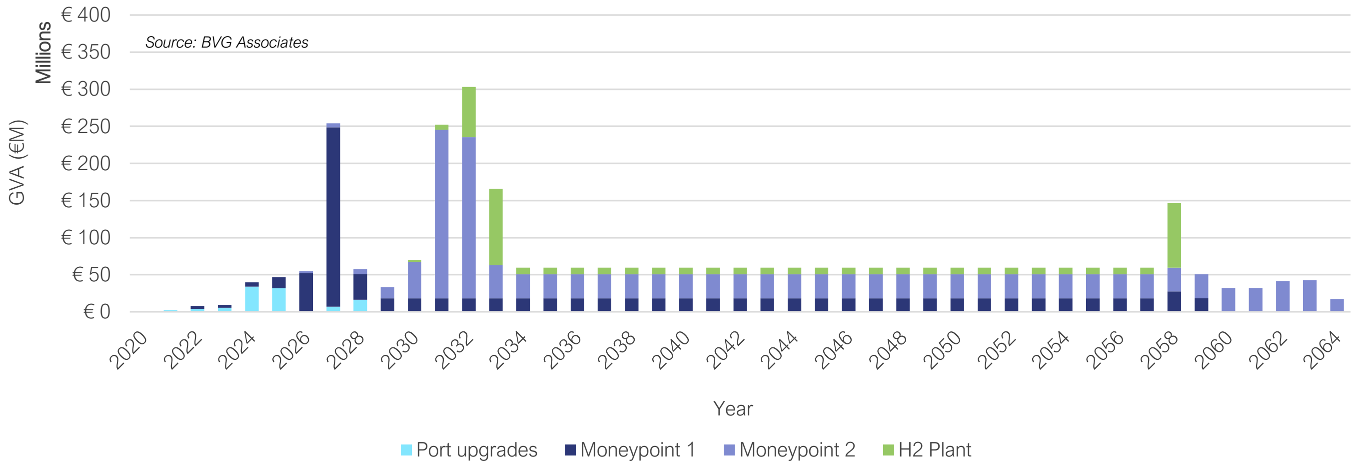

Figure 21 Irish GVA for Green Atlantic @ Moneypoint projects - steel floating foundation scenario

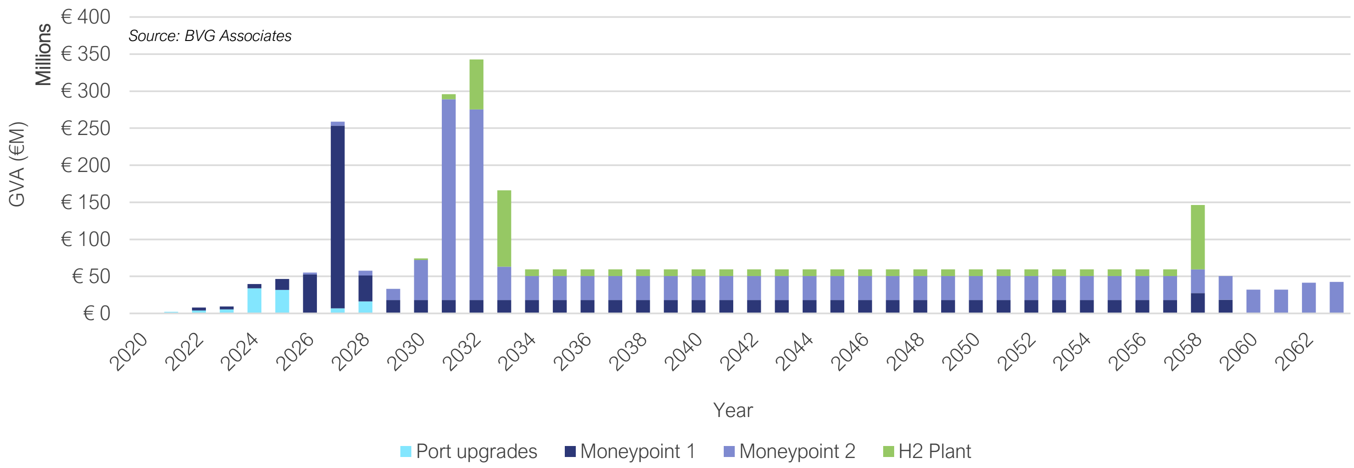

Figure 22 Irish GVA for Green Atlantic @ Moneypoint projects - concrete floating foundation scenario

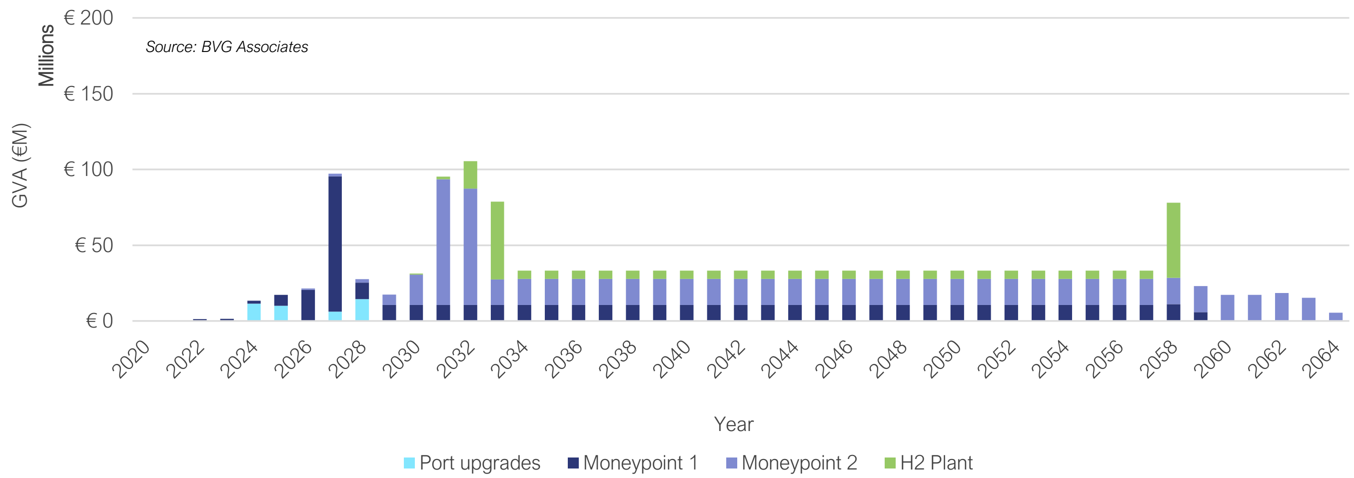

Figure 23 Local GVA for Green Atlantic @ Moneypoint projects - steel floating foundation scenario

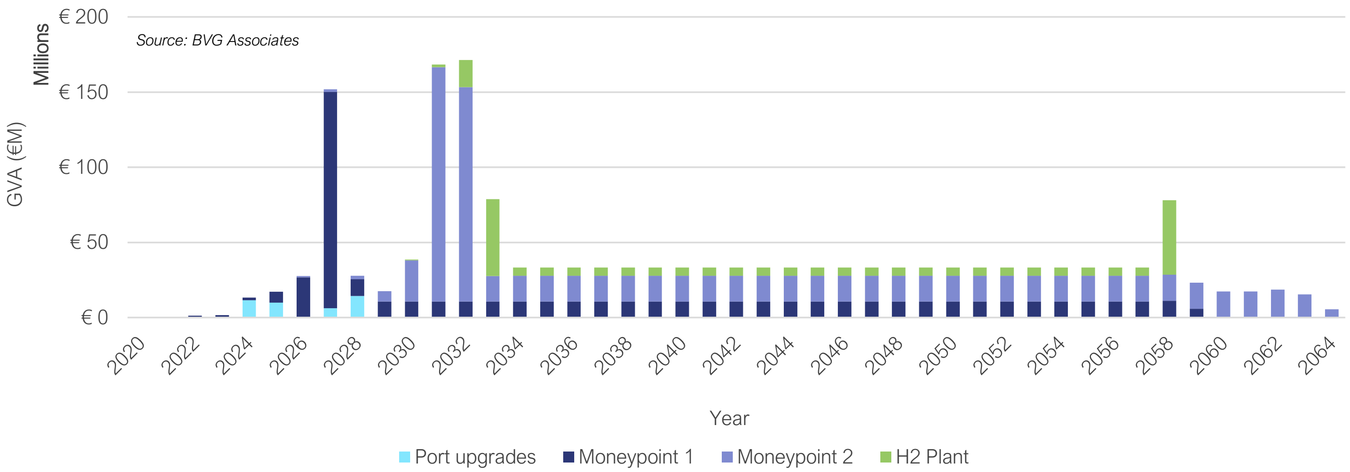

Figure 24 Local GVA for Green Atlantic @ Moneypoint projects - concrete floating foundation scenario

Appendix E FTEs from continuous deployment to 2050

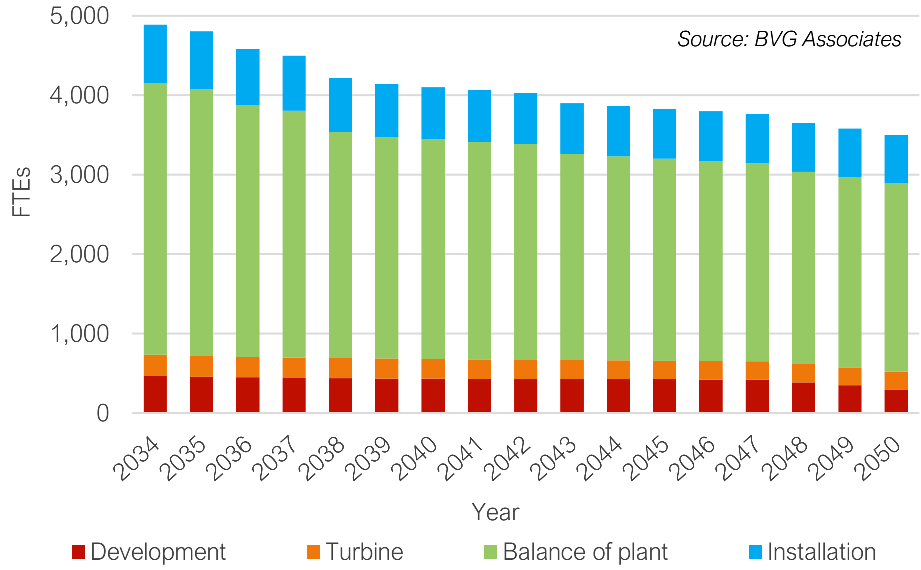

Figure 25 Irish FTEs from construction phase - concrete scenario

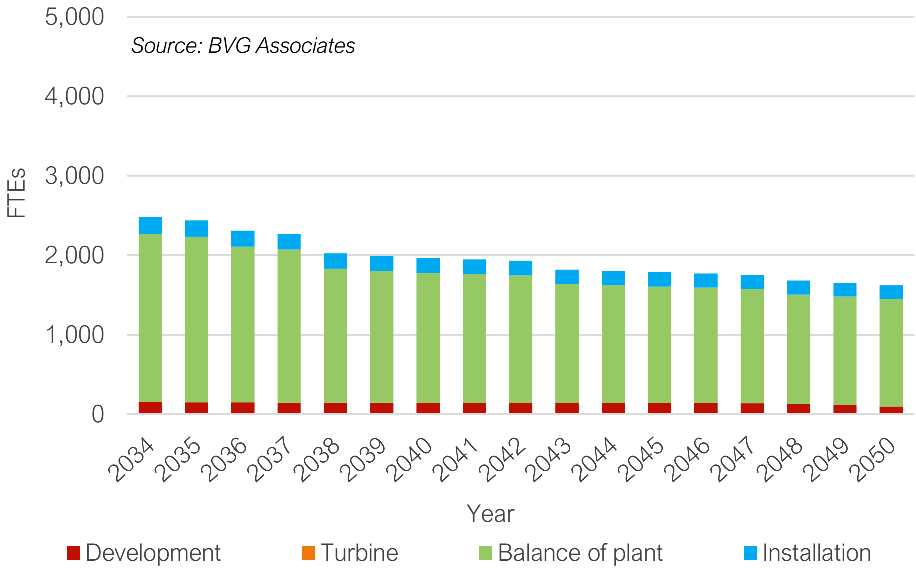

Figure 26 Local FTEs from construction phase - concrete scenario

frontier economics

REGULATORY IMPACT ASSESSMENT FOR HYBRID OFFSHORE WIND CONNECTION

Prepared for ESB

4 March 2022

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INTRODUCTION

ESB has commissioned Frontier Economics to undertake a Regulatory Impact Assessment of the facilitation of hybrid grid connections in Phases 2 and 3 of the Government's three-phased approach to offshore wind deployment.[1] In particular, we consider the potential impact of a regulatory change to allow for Hybrid Offshore Renewable Energy Projects.

In the following sections of this Regulatory Impact Assessment (RIA), we:

- set out the policy context and objectives of the proposed regulatory change;
- identify and describe the factual scenario (i.e. scenario assuming regulatory change is made) and counterfactual scenario (i.e. scenario assuming regulatory change is not made) for assessment;
- discuss the benefits that would flow from the proposed regulatory change;
- discuss potential concerns associated with the regulatory change; and
- conclude with an assessment of the proposed regulatory change.

[1] Department of the Environment, Climate and Communications (DECC) of the Government of Ireland, 'Policy Statement on the Framework for Ireland's Offshore Electricity Transmission System', 2021.

1 POLICY CONTEXT AND OBJECTIVES

This section sets out the relevant policy context and objectives of the proposed regulatory change.

Ireland has ambitious offshore wind targets

Developing offshore wind is a critical element in meeting Ireland's renewable energy targets. The Programme for Government and the 2021 Climate Action Plan (CAP) target at least 5 GW of installed offshore wind by 2030. The Programme for Government also indicates significant long-term ambitions for Ireland's offshore wind capacity, with floating offshore wind potential of at least 30 GW contributing to total offshore wind capacity of at least 35 GW over the next 20 years.[2]

These targets for offshore wind will also contribute to Ireland's RES-E targets. Ireland's legally binding RES-E target is 70% by 2030 according to the National Energy and Climate Plan. The Government has also more recently increased its ambition, committing to a target of up to 80% RES-E by 2030 in the Climate Action Plan 2021.[3]

There are challenges in meeting these targets under current arrangements

Achieving the 2030 offshore wind target will be challenging, as Ireland's existing grid capacity has limited ability to absorb the substantial additional generation envisaged. EirGrid suggests that only up to 1.75 GW[4] can be accommodated, under existing rules, without the need for significant deep reinforcement works.[5]

EirGrid has set out the reinforcement works that will be required in the Shaping Our Electricity Futures Roadmap.[6] Given the complexity of building network infrastructure, the timescale set out for completing the reinforcement works and connecting additional offshore wind is ambitious, with EirGrid having indicated that it will be "very challenging to deliver."[7] There is therefore a significant risk that, if there are delays to the completion of the required reinforcement, offshore wind projects may not be completed until after the 2030 target date. In an extreme scenario in which all reinforcement works face delays, there may be a gap of up to 3.25 GW between what the transmission system can currently feasibly accommodate and the 2030 offshore wind target.

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2 Eamon Ryan, Minister for Climate Action, Communication Networks and Transport, 'The European Green Deal: Future-Proofing Energy in Ireland' presentation, February 2021.

3 This increased target may become legally binding if incorporated into Ireland's National Energy and Climate Plan update in 2023.

4 As indicated by EirGrid to Relevant Projects in July 2020. We are not aware of a more recent update on this figure.

5 EirGrid and SONI, 'Shaping our electricity future, Technical report', 2021.

6 EirGrid and SONI, 'Shaping our electricity future, A roadmap to achieve our renewable ambition', 2021.

7 EirGrid and SONI, 'Shaping our electricity future, A roadmap to achieve our renewable ambition', 2021.

Hybrid wind connections are proposed as a potential solution to these challenges

In its Offshore Wind Phase Two Consultation ('the Consultation'), DECC has sought views as to whether hybrid grid connections should be facilitated. Hybrid grid connections (also referred to in this RIA as Hybrid Offshore Renewable Energy Projects) are defined by DECC as a single grid connection which facilitates the connection of both a thermal generation plant (existing or proposed) and a proposed offshore wind project to the onshore electricity transmission system.[8]

ESB considers hybrid offshore wind connections are an option to bridge the gap identified between what the transmission system can currently feasibly accommodate and the 2030 offshore wind target.

For example, a Hybrid Offshore Renewable Energy Project grid connection could be shared or co-located with an existing CCGT power station. Thus, the offshore wind and CCGT would share the existing grid infrastructure and contracted export capacity. Grid capacity for CCGT plants is typically designed to accommodate high onload running hours. However, many of these plants run less frequently, and thus there could be synergies in co-locating complementary generation – such as offshore wind – that could be connected without the need for additional deep network reinforcement. This will increasingly be the case in the medium term, as the role of thermal plant in producing electricity decreases further. As discussed below, there may be some loss in combined run time (compared to a scenario with independent connections and deep grid reinforcement), however this loss in run time is expected to be small due to the complementary nature of the technologies, and such losses would be internalised by the parties regardless (rather than be socialised, like additional reinforcement costs would be).

ESB has estimated that hybrid offshore wind connections could provide up to an additional 5.9 GW of offshore wind within the 2030 time scale. It therefore proposes that Hybrid Offshore Renewable Energy Projects be facilitated.

In the remainder of this report, we assess whether the proposed facilitation of Hybrid Offshore Renewable Energy Projects (through required regulatory changes) is likely to be net beneficial – in both meeting DECC's objectives of facilitating greater offshore wind and in bringing wider societal and customer benefits.

8 Department of the Environment, Climate and Communications (DECC) of the Government of Ireland, 'Offshore Wind, Phase Two Consultation', December 2021.

2 SCENARIO DEFINITION

To assess the impact of the proposed facilitation of Hybrid Offshore Renewable Energy Projects, this impact assessment compares the key outcomes in two potential states of the world:

- the scenario in which Hybrid Offshore Renewable Energy Projects are facilitated through any required regulatory changes (i.e. the factual scenario); and
- the scenario without the required regulatory changes (i.e. the counterfactual or status quo scenario).

Both scenarios require a number of steps to move an offshore wind project from the planning and development stage to operation. While the order of these steps is currently under Consultation by DECC, they include:

- receipt of state consent, or Maritime Area Consent (MAC), for offshore development;
- receipt of development permission, or planning permission;
- submission of grid application and receipt of connection offer from EirGrid (connection offer may be conditional)[9]; and
- qualification for and participation in Offshore RESS (ORESS) auction to obtain a route to market.

Following these steps, and subject to being successful in the ORESS auction or obtaining an alternative route to market such as a corporate power purchase agreement (CPPA), developers can begin construction and operation of the windfarm.

In both scenarios, with and without the regulatory change, we assume that the transmission network is currently constrained in its ability to accommodate sufficient additional offshore wind capacity, with capacity for only an additional 1.75 GW[10] of offshore wind projects if network reinforcements are not undertaken and up to 5 GW if all reinforcement works set out in the Shaping Our Electricity Future Roadmap are completed without delay.[11]

9 It is expected that ORESS 1 and ORESS 2 participation criteria will require that projects have a full or conditional connection offer from EirGrid, or an ability to show alignment with the grid capacity identified in EirGrid's latest roadmap, to demonstrate that they can come online in time to contribute to meeting the 2030 targets.

10 As indicated by EirGrid to Relevant Projects in July 2020.

11 Additionally, we recognise that, in theory, there could be a change to the current rules under which EirGrid could agree to connect new plants in advance of completing the deep reinforcement works that would normally be required (either retaining the current arrangements for redispatch, curtailment and compensation or with a new set of arrangements). We understand that no such rule changes have currently been proposed and therefore assume that they will not occur within a timeframe that would improve the ability of the network to connect offshore wind capacity by 2030. As such, we do not consider these rule changes further when assessing the proposed facilitation of Hybrid Offshore Renewable Energy Projects (and associated regulatory changes) and instead focus on continuation of the status quo, whereby the connection of additional capacity is facilitated through network reinforcements. However, we note that, were the proposed facilitation of Hybrid Offshore Renewable Energy Projects to be made alongside such a rule change, it would simply further expand the set of options for connection which a potential windfarm could consider.

Further detail on each scenario is discussed below.

2.1 The factual scenario – regulatory changes made to facilitate Hybrid Offshore Renewable Energy Projects

In the factual scenario, potential offshore wind projects will include:

- Projects with "standard" connections; and
- Hybrid Offshore Renewable Energy Projects.

Both of these project types would compete in the ORESS auctions for a route to market (how these RESS auctions will likely work is discussed further below).

2.1.1 Projects with "standard" connections

For projects with "standard" connections, as noted above, EirGrid has suggested that it can accommodate 1.75 GW of offshore wind capacity under existing conditions. To accommodate more offshore wind capacity, EirGrid would first need to complete deep network reinforcement. Subject to the completion of these reinforcement works, as set out in the Shaping Our Electricity Future Roadmap, up to 5 GW of offshore wind may be connected by 2030 using standard connections. We note that, given the complexity of delivering network reinforcement, there is a significant risk that some of the required works are not completed in time to allow connection by 2030.

2.1.2 Hybrid Offshore Renewable Energy Projects

Hybrid Offshore Renewable Energy Projects would use existing grid connection infrastructure to allow additional offshore wind capacity to connect without the need for planning and construction of additional major onshore grid infrastructure.

Regulatory changes will be required to facilitate Hybrid Offshore Renewable Energy Projects. In turn, these changes will enable planned offshore wind projects to be connected more quickly by utilising these connections.

ESB developed a set of criteria to identify potential Hybrid Offshore Renewable Energy Projects. Those criteria are:

- the site must have an existing thermal connection;
- be within 30 km from the coast; and
- within 50 km from potential offshore wind sites that have generation potential at least equal to the thermal connection.

Based on these criteria, an estimated 5.9 GW of existing thermal generation sites could potentially be used on a hybrid basis for 2030. These existing sites are owned by multiple operators including ESB, SSE, BGE, Energia and EPH, as set out in the table below. Whether each site would proceed with a hybrid connection and compete in the RESS auctions would be at the discretion of the site owner, but the regulatory change would provide them with this option which is not currently available.

Figure 1 Thermal generation sites with hybrid potential

Plant	Owner	MEC (MW)	Location
Aghada	ESB	904	Cork
Dublin Bay	ESB	415	Dublin
Great Island	SSE	431	Wexford
Huntstown	Energia	764	Dublin
Moneypoint	ESB	915	Clare
North Wall	ESB	236	Dublin
Poolbeg	ESB	460	Dublin
Tarbert	SSE	589	Kerry
Tynagh	EPH	404	Galway
Whitegate	BGE	445	Cork
Total		**5,563**	

Source: ESB

ESB considers that, if allowed, hybrid projects will be able to compete in the scheduled ORESS 2 auction for offshore wind (in 2024 or 2025). This would allow contracted projects to be operational by mid-2028.

2.2 The counterfactual scenario – no regulatory change to facilitate Hybrid Offshore Renewable Energy Projects

Without regulatory change, potential offshore wind projects will only include “standard” connections.

To accommodate additional offshore wind, EirGrid will need to undertake deep reinforcement of the network. Given the time needed to plan and undertake such reinforcements, there is a significant risk that EirGrid will not be able to complete sufficient deep network reinforcement by 2030 for the full 5 GW of wind to connect using standard connections. We note that historically, adding significant grid capacity has been a time-consuming process. It is therefore likely that in the counterfactual scenario there is a significant risk that the 2030 offshore wind target will be missed, potentially by as much as 3.2GW if all planned reinforcement works encounter delays.

3 BENEFITS ASSOCIATED WITH THE REGULATORY CHANGE

This section assesses the potential benefits arising from the proposed regulatory change – that is, the net benefits of the factual compared to the counterfactual. We consider these benefits from both a societal and customer perspective. The benefits discussed in turn below are:

- an increased likelihood of meeting Ireland's 2030 offshore wind targets;
- lower carbon emissions;
- lower electricity prices for consumers;
- reduced network investment costs; and
- potential increased competition for RESS subsidies.

3.1 Increased likelihood of meeting offshore wind targets

As discussed above, Ireland is targeting 5 GW of additional offshore wind capacity by 2030. Without the facilitation of Hybrid Offshore Renewable Energy Projects through required regulatory changes, we understand that there will need to be significant deep reinforcement of the network to accommodate more than 1.8 GW of additional offshore wind. This leaves a potential gap to target of up to 3.2 GW.

Allowing hybrid connections increases the number of projects that can qualify for ORESS auctions with a viable path for 2030 connection. If the proposed regulatory change is made, 5.9 GW of existing thermal capacity becomes available for potential hybrid connections. The associated potential increase in connected offshore capacity in the factual scenario may be enough, therefore, to:

- enable Ireland to reach the 5 GW target if the required reinforcement works for standard connections are delayed, subject to the availability of appropriate support payments; and/or
- provide headroom between the offshore wind generation target and the available capacity on the system.

Even if all potential hybrid sites are not utilised, any additional offshore capacity gained through hybrid connections will get Ireland closer to meeting or over-delivering on the 2030 targets than if it relies solely on the standard connection process. Hybrid connections therefore increase the likelihood of meeting 2030 offshore wind targets.

3.2 Lower carbon emissions

Increases in the level of offshore wind connected by 2030 will lead to lower carbon emissions in Ireland and thus increase the likelihood that Ireland will meet its 2030 emissions reductions targets.[12] The extent of this reduction will depend on the thermal generation displaced and the ability of the Irish system to utilise renewable generation when it is available.

A previous study[13] conducted by UCC on behalf of the Electricity Association of Ireland suggests that increasing the level of offshore wind from approximately 1 GW to 5 GW would reduce carbon emissions by approximately 1.3 Mt in 2030. Valued at the current EU ETS carbon market price, this is equivalent to savings of approximately €113 million. The increased connection examined in the study provides a good indication of the potential levels of reduction in carbon emissions that could come from hybrid connections coming online by 2030, assuming that hybrid connections assist in reaching the 5 GW target.

3.3 Lower electricity prices for consumers

Additional offshore wind capacity being connected to the grid may also lower wholesale energy prices to customers, as wind has lower marginal costs than other generation types.

ESB has undertaken analysis to investigate the impact of increased renewable generation on wholesale energy prices. This internal analysis has shown that increased renewable generation penetration is expected to lead to a modest reduction in wholesale energy prices. Additionally, it found that decreases in wholesale prices could follow if system flexibility is increased, as this would reduce the system's reliance on more expensive peaking plant when wind generation is not available. These reductions in wholesale energy prices would be expected to feed through to lower electricity prices for consumers.

Some of the benefit of lower wholesale costs may be offset by higher renewable support costs, constraints costs and ancillary services costs that would come about due to increased renewable penetration. However, Baringa previously found that increasing Ireland's penetration of renewable electricity in 2030 from 40% to 70% can be delivered with net[14] savings to Irish consumers if the levelised cost of energy (LCOE) over 20 years is less than:

- €60/MWh for onshore wind;
- €70/MWh for offshore wind; and
- €80/MWh for solar PV.[15]

3.4 Reduced network investment costs

The use of hybrid connections can lead to reduced network investment costs. This may be because some investments will not be required or because they will be delayed, thereby resulting in a time value of money saving. We note that, given the length of time it takes to complete transmission network reinforcements and the

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12 We note that the EU ETS cap will remain unchanged, so overall European emissions will not go down.

13 'Our Zero Mission Future'; MaREI and Electricity Association of Ireland, 2020.

14 That is, after taking account of renewable support costs, constraints costs, DS3 costs and network reinforcement costs.

15 Baringa, '70 by 30, A 70% Renewable Electricity Vision for Ireland in 2030', October 2018.

fact that the 2030 offshore wind targets are only the beginning of significant wind ambitions in Ireland, EirGrid may begin reinforcement at the same time regardless of hybrid connections. The impact of reduced network investment costs may therefore be more muted if EirGrid begins to undertake investment pre-emptively rather than when a constraint is triggered by new capacity looking to connect.

Network reinforcements are largely driven by new generation or demand connections, with the scale of reinforcements depending on both the location and size of the connection. There is therefore no single estimate of reinforcement costs per MW of new offshore wind capacity that can be used, as this will vary by project. Therefore, to estimate the extent of network reinforcement displaced, the costs associated with specific alternative offshore wind farm sites would need to be calculated.

In EirGrid's recently published report[16] on Ireland's electricity future, it modelled a number of potential future scenarios and the associated reinforcement costs. While these costs relate to both offshore wind and other renewables, they can provide some indication of the scale of reinforcements needed. This report finds that, if new generation continues to be connected in developer requested locations, reinforcements of approximately €1.9 billion would be required to meet a 70% renewables target by 2030. This expenditure would facilitate:

- 1.8 GW of offshore wind;
- 8.2 GW of onshore wind; and
- 2 GW of solar capacity.

These costs would be higher again if the full 5 GW of offshore wind targeted for 2030 were to be connected.

In a scenario where new generation is connected at sites determined by Government policy (accounting for the strength of the existing grid and local demand), these costs may be significantly lower. In EirGrid's modelled 'Generation-Led' scenario, it found that reinforcement costs of €715 million would be required to connect:

- 4.5 GW of offshore wind;
- 4.4 GW of onshore wind; and
- 0.6 GW of solar capacity.

These figures show the potential scale of the reduction in costs associated with a reduced need for network reinforcement. Maximising the use of existing infrastructure through the use of hybrid connections may be another way to bring about these cost savings.

3.5 Potential increased competition in the Offshore RESS auction

This section considers the potential benefit from increased competition in the ORESS auctions through greater capacity being available.

[16] EirGrid and SONI, 'Shaping our electricity future, Technical report', 2021.

While the details of the ORESS auctions have not yet been finalised, we understand that there are expected to be two auctions held to support 2030 projects. These are:

1. an auction in 2022 which is to be ringfenced for Relevant Projects (i.e. Phase 1 projects); and
2. an auction in 2024 or 2025 which is likely to include:
   a. Relevant Projects that were not contracted in the first auction; and
   b. Phase 2 projects which the Department has identified as able to connect by 2030.

Following these two ORESS auctions, an enduring regime will be implemented to take advantage of Ireland's offshore wind potential post-2030.

As above, it is expected that one of the qualification criteria for the Phase 2 ORESS auction will be that projects prove deliverability for 2030 by either:

- receiving a provisional connection offer from EirGrid; or
- having the ability to demonstrate alignment with the grid capacity identified in EirGrid's latest roadmap.[17]

Hybrid connections would be expected to increase the number of projects that are able to receive a provisional connection offer. This would result in more projects qualifying and thus more projects competing in the ORESS auctions where a provisional connection offer forms part of the qualification criteria. This would be particularly the case if "standard" connections struggled to get connection offers beyond the 1.8 GW indicated of capacity available prior to the completion of reinforcement works.

As set out in the Consultation document, some of the Phase 2 process options being considered propose to hold the ORESS 2 auction in advance of MAC application and the receipt of a provisional connection offer (Options C and D). Even where a provisional connection offer is not a requirement for participating in the ORESS auction, the use of hybrid connections is likely to open additional geographic areas for offshore renewable development with pre-2030 delivery (i.e. beyond the areas identified for RES generation technology connection in EirGrid's Shaping Our Electricity Future Roadmap, which are predominantly located on the East coast). We expect that this would also lead to an increase in the number of projects competing in the ORESS auction.

We understand from ESB that hybrid projects would be ready to compete in the ORESS 2 auction. If facilitated, the impact of this increased competition would likely be lower subsidy payments, for a given capacity to be procured, in turn benefiting consumers through lower prices.

[17] EirGrid and SONI, 'Shaping our electricity future, A roadmap to achieve our renewable ambition', 2021.

4 POTENTIAL CONCERNS ASSOCIATED WITH THE REGULATORY CHANGE

In this section we discuss potential concerns in relation to adverse impacts from the proposed regulatory change. These potential concerns are:

- reduced generation scheduling efficiency;
- hindering competition through increased concentration; and
- impacts on investor behaviour.

These are discussed in the following sections.

4.1 Efficiency of dispatch

The first potential concern is whether the regulatory change brings about a loss of efficiency through changes in electricity market dispatch.

This inefficiency may arise if both wind and gas are needed on the system at the same time:

- In the case where wind and gas plants are connected separately to the grid and both are needed on the system, wind plant would most likely run – given it has zero marginal cost and is in receipt of a subsidy – alongside the most efficient gas plant.
- In the case of a hybrid wind and gas connection, a hybrid connection owner will optimise the running of the gas and wind plant to maximise return. There may be scenarios in which a hybrid connection owner may prefer to run their wind plant, and so will effectively not bid their gas plant, which could have been in merit had it been bid. A less efficient gas plant may therefore be dispatched as a result of the generation owner's choice to run the wind plant and not bid the gas plant. Alternatively, if the hybrid connection gas plant is constrained on for system services reasons, such as inertia or ramping requirements, the wind plant will have limited running time.

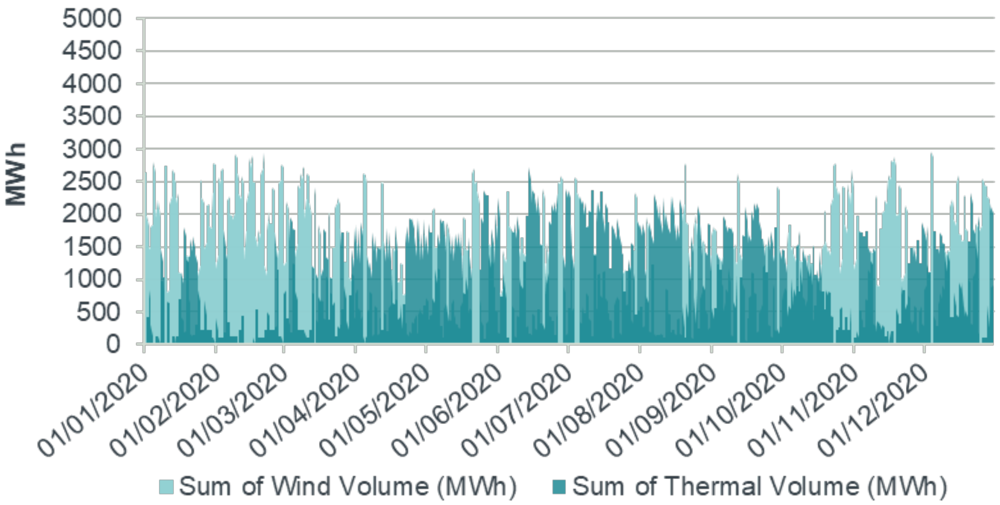
This concern is most relevant where:

- both the gas and wind plant at the hybrid connection would have been in merit at the same time; and
- there is a material difference in the resource cost between the hybrid connection gas plant and the gas plant that replaces it.

To investigate the extent to which this arises, ESB has examined the complementarity of thermal and offshore wind by modelling a scenario in which the Poolbeg plant shares its grid connection with a 500 MW offshore windfarm located off the coast of Dublin. The modelled scenario assumed a capacity factor of 45% for the offshore windfarm and that the windfarm was curtailed whenever the plant was running. ESB found that the hybrid grid connection results in grid curtailment of approximately 40 GWh per year. This curtailment results in a hybrid capacity factor of approximately 44%, which suggests a minimal reduction in efficiency relative to the potential offshore capacity factor of 45%.

While this analysis has focused on a single plant, looking more broadly at the 2020 day-ahead hourly volumes from large thermal units and wind in I-SEM shows a strong negative correlation between the two sources of generation in Ireland. This suggests that the results of the Poolbeg analysis above are likely applicable to other thermal plant. This negative correlation is shown in Figure 2 below.

Figure 2 Correlation between wind and thermal generation (2020)



Source: ESB analysis of day-ahead bid volumes

On the second point, the costs associated with the inefficient dispatch of thermal plant will be higher if there are larger price differences between thermal plants, such that dispatching the less efficient plant is significantly more expensive than the efficient plant. In Ireland, the price difference between gas CCGT plants is limited, resulting in a relatively flat supply curve. Any inefficiency associated with deviations from the optimal dispatch are therefore unlikely to have a material impact on costs.

4.2 Competition

The second concern relates to the potential for competition to be distorted or weakened. In assessing the likely costs, we look at competition in both:

- RESS auctions; and
- the electricity market.

We also consider whether allowing for hybrid connections could be considered to be State aid.

4.2.1 RESS auctions

As noted above, providing for hybrid connections will increase the potential volume of offshore wind eligible to compete in RESS auctions. There is therefore no weakening or distortion of competition.

4.2.2 Electricity market

A second potential competitive concern could exist in electricity markets. This concern could arise if allowing an incumbent thermal generator to change its existing thermal connections to hybrid connections could allow it to establish a significant market share in RES production that would enable it to exercise market power.

We consider that this concern would not give rise to a negative impact on competition for a number of reasons.

First, offshore wind that is in receipt of a RESS subsidy will be subject to a two-way CFD, which means that it essentially gets a fixed price for production regardless of the actual wholesale price in the market. This fixed price, or strike price, will be determined through a competitive auction in which each generator is incentivised to bid in line with its costs in order to maximise its chance of being contracted. As such, a generator would have no increased incentive to artificially increase the wholesale price, for example by curtailing thermal production, as any increase in the wholesale price above the auction strike price would not be retained.

A generator would also have no incentive to curtail its wind production to try to increase the thermal price for a number of reasons. First, wind receives a high subsidy per MWh so there would be a significant financial disincentive to withholding. Additionally, the withholding of wind capacity can be easily seen by regulators, as the windfarm should be running anytime the wind is blowing. As discussed below, this kind of market manipulation is monitored and prohibited by existing regulations.

Second, beyond the lack of incentives to increase the wholesale price, generators face regulatory constraints which prevent the abuse of market power. In particular, the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT)[18] addresses market abuse and transparency in the wholesale energy market. In its market abuse provisions, REMIT specifically prohibits market manipulation. The Agency for the Cooperation of Energy Regulators (ACER) has published detailed guidance on the application of REMIT, including specific examples of what constitutes market manipulation in the energy market.[19] Among other things, this regulation specifies that the following types of capacity withholding are prohibited:

- economic withholding, or the offering of available generation capacity at prices above the market price that are not cost reflective, resulting in the asset not being dispatched; and
- physical withholding, such that available generation capacity is not offered at any price.

REMIT also requires market participants to publish key information about generation plant, including information on outages and closures. This creates a

[18] Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency.

[19] Guidance on the application of Regulation (EU) No 1227/2011 of the European Parliament and of the Council of 25 October 2011 on wholesale energy market integrity and transparency; 5th Edition. Updated 18 November 2020.

high degree of transparency in the market, such that any attempts at withholding wind generation would be even more obvious.

To ensure that the regulation is adhered to, the SEM Committee has a specific market monitoring unit to ensure compliance with REMIT. Therefore, it is unlikely that an offshore wind generator would exercise market power and impact the wholesale market price, as such behaviour would be observed and punished.

4.2.3 State aid

A final competitive concern may arise if the facilitation of hybrid connections gave rise to State aid concerns.

To fall within the category of prohibited State aid, the following four conditions must hold:

- The aid is granted or imposed by a public authority.
- The measure results in a transfer of resources from the State or the State receiving less resources.
- The aid distorts, or threatens to distort, competition by favouring certain undertakings or the production of certain goods.
- The measure must affect trade between EU member states.

In the context of facilitating hybrid connections, we do not consider that these four conditions are met. This is because:

- there is no involvement or planned transfer of State funds to the owners of hybrid connections;
- allowing hybrid connections does not provide then with a selective advantage, rather it is simply a way to use existing connections more efficiently; and
- allowing hybrid connections will not limit competition or have an effect on trade, as discussed in the previous sections.

On this basis, the proposed regulatory change cannot be considered to be State aid.

4.3 Investment

The final potential concern relates to whether allowing hybrid offshore wind connections would discourage investors from entering the Irish market, potentially slowing the development of the offshore wind sector to the long-term detriment of Irish energy consumers.

We consider that there are two groups of investors which are of interest:

- existing investors in Relevant Projects; and
- longer-term investors for projects which are not currently underway.

In relation to existing investors in Relevant Projects, the inclusion of hybrid offshore wind connections is unlikely to discourage investors. This is because these investors are in a priority position for consent and development, having already been given policy certainty and support. For example, the first ORESS auction will be limited to only the Relevant Projects.

The facilitation of hybrid connections would also be unlikely to deter future investors who are likely to be interested in the time horizon beyond 2030. Ireland has large total offshore wind ambitions, with capacity targets likely to be in excess of 30 GW of potential offshore floating wind power identified in the Programme for Government. In this context, hybrids can be seen as a transitional solution to provide more capacity in the near term while acknowledging that the 2030 target will be a small part of the long-term offshore wind market. As such, the regulatory change will not diminish the overall opportunity and attractiveness for investors in the Irish offshore wind market.

5 CONCLUSION

The table below summarises the key differences identified between the factual and counterfactual scenario outcomes, as outlined in the sections above.

Figure 3 Summary of key outcomes

	Factual	Counterfactual (status quo)
2030 offshore targets	Potential to meet or over-deliver on targets	Potential for targets to be missed if the significant required reinforcement works are delayed
Reinforcement	Reduced reinforcement required to meet 2030 targets	Significant deep reinforcement required to meet 2030 targets
Carbon	Save approx. 1.3Mt more than under status quo	Carbon savings associated with integrating 1.75 GW of offshore wind
Electricity prices	Reduced	No change
RESS competition	Increased competition in RESS auction	Limited competition or ability to procure less offshore wind through RESS auction
Thermal efficiency	Slight reduction	No change
Electricity market competition	No change	No change
Investment	No change	No change

Source: Frontier Economics

The proposed facilitation of Hybrid Offshore Renewable Energy Projects through the required regulatory change provides an additional option for meeting Ireland's 2030 offshore wind targets and, consequently, Ireland's RES-E targets. Connecting offshore wind projects into existing thermal generation sites is a practical solution that allows for existing infrastructure to be used in a more efficient way.

The key benefit associated with the proposed changes is to:

- increase the prospect of meeting or over-delivering on the 2030 offshore wind connection target; and
- significantly reduce carbon emissions, thereby contributing substantially to the achievement of our 2030 emissions reduction targets.[20]

The proposed changes may also result in more competitive RESS auctions, with consequent benefits for consumers in the form of lower support payments.

[20] The 2030 target of 5 GW of offshore wind has currently only been listed in the Programme for Government and 2021 Climate Action Plan, and therefore does not yet carry a financial penalty. However, we would expect that in time it will be rolled into Ireland's medium-term commitments (for example, through Ireland's National Energy and Climate Plan update in 2023). Moreover, offshore wind will be a major contributor to Ireland's: i) 2030 RES-E targets; ii) EU emissions reduction target for 2030 of 30% relative to 2005 levels; and iii) recent commitment to reduce greenhouse gas emissions by 51% by 2030, relative to 2018 levels. These targets are legally binding obligations. Therefore, there may be associated penalties if Ireland fails to meet its 2030 targets. For example, Ireland previously paid approximately €150 million for carbon credits to compensate for missing its 2020 target of reducing emissions be 20% relative to 2005 levels.

We have assessed whether there are any concerns associated with the proposal. We find no evidence to suggest that the proposal will give rise to negative effects, as:

- the risk of reduced efficiency of dispatch appears minimal; and
- concerns with adverse impacts on competition or longer-term investment are highly unlikely given market structures and protections in place.

As a result, we consider that there will be no negative impact on future investments into and development of the Irish offshore wind market resulting from this regulatory change.

In summary, the change to allow for hybrid connections appears a pragmatic and low-cost option to facilitate more offshore wind to connect in a timely way, thus increasing the likelihood of meeting our 2030 targets.

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