Appendix 5-11
Supporting Information Demonstrating the Applicant's Experience on Other Offshore Wind Farm Projects

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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A TETRA TECH COMPANY

PARK WIND
JERA GROUP

ESB
Energy for generations

MAKING COMPLEX EASY
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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Appendix 5-11: Supporting Information Demonstrating the Applicant's Experience on Other Offshore Wind Farm Projects

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PROJECT PROMOTORS

Oriel Windfarm Limited is an Irish company established in 2005 to develop the Oriel Wind Farm Project. The Project is a joint venture between Parkwind N.V. and ESB Wind Development a wholly owned subsidiary of Electricity Supply Board (ESB). A joint venture agreement has been executed between Parkwind and ESB to formalise the joint development of the project. Parkwind NV hold a controlling number of shares in the joint venture company.

Parkwind N.V. is a green energy company that develops, finances and operates offshore wind farms. With more than a decade of experience and 771 MW under operational management in the Belgian North Sea, Parkwind is currently expanding internationally and has an active development pipeline of 4.5GW (net) across a number of European and other markets where it is working with a number of credible partners. Parkwind also recently completed construction of the 257MW Arcadis Ost 1 project in Germany which it now operates. Committed to making green energy available and affordable for everyone through its unique approach covering the entire value chain of offshore wind, Parkwind has established itself as a reliable and competitive partner to communities, governments and suppliers globally. Composed of over 130 professionals operating in Belgium, Germany, Ireland, Norway, Greece, and Australia/New Zealand.

ESB, is Ireland's leading electricity utility which was established in 1927. The Irish Government are the majority shareholders of ESB. As part of their Brighter Future Strategy, ESB work with a range of companies to bring low carbon and renewable energy developments to the market (Oriel Windfarm, 2020). In 2019, ESB took a stake in the Neart na Gaoithe offshore windfarm, currently in construction off the east coast of Scotland. More recently, ESB took a 50:50 joint venture stake in Inch Cape Offshore Limited, a large wind farm development in the earlier stages of development off the east coast of Scotland.

JERA Co. Inc, Parkwind is a wholly owned subsidiary of JERA. JERA was created through the consolidation of the fuel and thermal power departments of the Tokyo Electric Power Company and the Chubu Electric Power Company. The company was established with the concurrent aims of creating an energy company capable of competing in the global energy market and providing a stable supply of globally competitive energy, all while increasing corporate value.

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

ABOUT PARKWIND

- Parkwind is a Belgian-based company that develops, finances and operates offshore wind farms. Committed to a sustainable future and with a long-term investment horizon.
- In just over ten years, Parkwind has become a major independent offshore wind developer, with 771MW of operational capacity in the Belgian North Sea and 257MW in the German Baltic Sea.
- Actively pursuing global opportunities and further expansion, Parkwind currently has more than 1GW under development.
- Parkwind has an in-house team of world leading offshore energy experts. Together with suppliers, universities and project partners, Parkwind's innovation spans across engineering, materials science, data acquisition, multi-use of wind farms, energy storage and installation methods.
- Our company has a strong track record of innovation. We have been an active participant in industry developments by installing and testing new solutions in our windfarms.
- Our latest project under construction, Arcadis OST used a ground-breaking WTG floating installation method, a first for the offshore wind industry.

ABOUT ESB

- ESB is a leading Irish utility, with an extensive track record of delivering renewable energy projects
- Established in 1927, ESB is a semi-state utility which operates right across the electricity market from generation, through transmission and distribution, to supply, with over 8,000 employees. ESB has ambitious targets with respect to renewable energy generation with its new corporate strategy “Driven to make a difference” targeting net Zero by 2040. Offshore wind, onshore wind, solar and renewables enabling technologies such as battery storage will be the main technologies deployed to meet this strategy. In particular, ESB is dedicated to being a market leader in Offshore wind in ROI, as evidenced by ESB’s ambition to generate at least 5GW of renewable power generation capacity by 2030.
- ESB currently operate 5.4GW of generation assets across Ireland and the UK. ESB has a strong track record in developing projects, including c.1GW of renewable power capacity in Ireland and the UK. The renewable asset fleet is comprised of wind generation (onshore & offshore), solar, hydro, pumped storage and batteries. This includes 720MW of operational onshore wind, with 2.7GW in development.
- Additionally, ESB has and is continuing to build a strong competence in offshore Wind, having first entered the UK offshore wind market in 2017 and since then has developed a large footprint across the UK as well as ROI with c.7.5GW of offshore wind in development and construction in UK and Ireland involving several strategic development partnerships.

EXPERIENCE AND EXPERTISE

1 DEVELOPMENT

Over 14 years of experience In project development.

2 FINANCING

Lasting relationships with financial institutions.

3 CONSTRUCTION

Supplier relationships & supply chain knowledge.

4 O&M

13 years of Operations & Maintenance expertise.

5 DECOMISSIONING

Know-how across the full project value chain.

PARKWIND

PARKWIND EXPERIENCE - BELWIND

BELWIND
OFFSHORE RENEWABLE ENERGY

Belwind is the first project successfully developed, financed and constructed by Parkwind (Colruyt Group). It was constructed on schedule and within budget, 46 km from shore in the Belgian sector of the North Sea. Fifty-five turbines spread over 17km2 generate enough energy to power the equivalent of 170,000 homes. Since the start of operations, Parkwind took charge of the operation and maintenance of the offshore wind farm.

In 2011 Parkwind reached an agreement with Alstom to integrate a prototype Haliade 150-6MW (direct drive) into the Belwind concession, allowing Alstom to live-test and assess their prototype in real offshore wind and sea conditions. Parkwind is responsible for the operation and maintenance of the demonstration project since 2013. The Belwind site has been utilized as testing ground for several R&D projects including the testing of the Alstom Haliade 150-6MW helping Parkwind and the industry at that time to make important steps in advancing offshore wind technologies.

ORE Project	Belwind – 165 MW Offshore Wind Farm
Location of Project	Belgian North Sea
Project Overview	• 165 MW • 47 KM from shore • Between 18 -31mts depth • 55 Vestas turbines / 3MW V90 • Powers 170,000 households
Project Timeline	• Development phase: 20 Feb'08 – 24 Jul '09 • Environmental Permit Obtained: 20 Feb' 08 • Construction phase: 24 Jul '09 – 09 Dec '10 • Operational phase: 09 Dec '10 – in operation
Parkwind project Scope	Parkwind was responsible for the final stage of the development, financing, construction and operation of Belwind. The project has a total installed capacity of 171 MW: - 165 MW, comprising 55 x 3MW wind turbines installed on monopile foundations - 6MW, comprising 1 x 6 MW wind turbine installed on jacket foundation.
Current status of Project	Operational Phase

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

PARKWIND EXPERIENCE - NORTHWIND

Northwind
Offshore Energy

Northwind is the second project successfully developed, financed and constructed by Parkwind. It was constructed on schedule and within budget, 37 km from shore in the Belgian sector of the North Sea. Seventy-two turbines spread over 14.5km2 generate enough energy to power the equivalent of 200,000 homes.

Parkwind obtained the first concession in 2006. In 2009 Parkwind submitted an application for an extension of the zone, which was granted in 2010.

ORE Project	Northwind – 216 MW Offshore Wind Farm
Location of Project	Belgian North Sea
Project Overview	• 216 MW • 37 KM from shore • Between 16 -29mts depth • 72 Vestas Turbines/ 3MW V112 • Powers 220,000 households
Project Timeline	• Development phase: 11 Nov '09 – 28 Jun '12 • Environmental Permit Obtained: 19 Nov '09 • Construction phase: 28 Jun '12 – 30 Jun '14 • Operational phase: 30 Jun '14 – in operation
Parkwind project Scope	Parkwind was responsible for the full design, development, financing, construction and operation of Northwind. The project has a total installed capacity of 216 MW, comprising 72 x 3MW wind turbines installed on monopile foundations.
Current status of Project	Operational Phase

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

PARKWIND EXPERIENCE - NOBELWIND

NOBELWIND
OFFSHORE RENEWABLE ENERGY

Following the success of the Belwind and Northwind projects, Nobelwind is the third project successfully developed, financed and constructed by Parkwind. It was constructed on schedule and within budget, 47 km from shore in the Belgian sector of the North Sea. Fifty turbines spread over 19.8km2 generate enough energy to power the equivalent of 190,000 homes.

Nobelwind – 165 MW Offshore Wind Farm	
Location of Project	Belgian North Sea
Project Overview	• 165 MW • 47 KM from shore • Between 25 -38mts depth • 50 Vestas / 3,3MW V112 • Powers 170,000 households
Project Timeline	• Development phase: 20 Feb '12 – 06 Oct '15 • Environmental Permit Obtained: 20 Feb' 08 • Construction phase: 06 Oct '15 – 24 May '17 • Operational phase: 24 May '17 – in operation
Parkwind project Scope	Parkwind was responsible for the full design, development, financing, construction and operation of Nobelwind. The project has a total installed capacity of 165MW, comprising 50 x 3.3MW wind turbines installed on monopile foundations.
Current status of Project	Operational Phase

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

PARKWIND EXPERIENCE – NORTHWESTER 2

NORTHWESTER 2
OFFSHORE RENEWABLE ENERGY

Northwester 2 is the fourth project successfully developed, financed and constructed by Parkwind, on schedule and within budget. The project is located in the Belgian North Sea, 51 km from shore. Twenty – three turbines spread over 11.7km^2 generate enough energy to power the equivalent of 220,000 homes.

The project faced many challenges in its final stages of construction, including powerful storms during the winter of 2019/20, which caused temporary disruption, and the outbreak of the COVID-19 pandemic, which brought an unprecedented level of uncertainty. Despite these difficulties, the team managed to keep the project on track, demonstrating Parkwind's ability to manage emerging risks and solve problems under difficult circumstances. First ever commercial deployment of MHI Vestas 9.5 MW turbine technology, the largest wind turbine ever deployed at scale. Effective application and development of Parkwind Quality Management System. Full and effective compliance with consent conditions.

ORE Project	Northwester 2 Offshore Wind Farm
Location of Project	Belgian North Sea
Project Overview	• 219 MW • 51 KM from shore • Approximately 35mts depth • 23 MHI Vestas Turbines / 9.5MW V164 • Powers 220,000 households
Project Timeline	• Development phase: 18 Dec '15 – 05 Oct '18 • Environmental Permit Obtained: 6 July '15 • Construction phase: 05 Oct '18 – 14 May '20 • Operational phase: 14 May '20 – in operation
Parkwind project Scope	Parkwind was responsible for the full design, development, financing, construction and operation of Northwester 2. The project has a total installed capacity of 219MW, comprising 23 x 9.5MW Vestas wind turbines installed on monopile foundations.
Current status of Project	Operational Phase

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

PARKWIND EXPERIENCE – ARCADIS OST 1

ARCADIS OST I
OFFSHORE RENEWABLE ENERGY

In April 2018, Parkwind was awarded a project of 257 MW in the Baltic Sea (Arcadis Ost 1), as a result of the competitive German 2018 offshore wind auction. Arcadis Ost 1 is the fifth project successfully developed, financed and currently being under construction by Parkwind. The project is located in the Baltic Sea, 19 km from shore. Twenty – seven turbines spread over 29km^2 generate enough energy to power the equivalent of 290,000 homes.

The development of Arcadis Ost 1 - a project with extremely challenging site conditions, located in the Baltic Sea – provided an opportunity for Parkwind to explore and pioneer with innovative designs and installation methodologies including a floating turbine installation method, which was applied for the first time at a commercial-scale, fixed foundation wind farm. The project also features next generation monopiles, the largest monopiles globally. These foundations were installed from floating DP3 vessel, another first for a commercial scale offshore windfarm.

ORE Project	Arcadis Ost 1 Offshore Wind Farm
Location of Project	German Baltic Sea
Project Overview	• 257 MW • 19 KM from Rugen Island • Up to 45m water depth • 27 Vestas turbines / 9.5 MW V164 • Powers 290,000 households
Project Timeline	• Development phase: 18 May '14 – 16 Jun '21 • Environmental Permit Obtained: 31 March '21 • Construction phase: 16 Jun '21 – 31 Dec '22 • Operational phase: `January 2023
Parkwind project Scope	Parkwind was responsible for the full design, development, financing, construction and operation of Arcadis Ost. The project has a total installed capacity of 257MW, comprising 27 x 9.5MW Vestas wind turbines installed on monopile foundations. The project required innovative technical solutions, including: • Foundations Installed using a DP3 floating vessel (industry first). • Turbines installed using a heavy lift floating barge (industry first).
Current status of Project	Operational Phase

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

PARKWIND PROJECT SCOPE EXPERIENCE

Parkwind was responsible for executing or managing all aspects of these offshore projects, including the accrual of direct experience in the following sub-categories:

- Full responsibility for Health & Safety including management systems; monitoring, recording and analysis of incidents & production of statistics; risk assessment / management; training provision.
- Full responsibility for environmental and consenting activities including assessments; consenting activities; measurement / monitoring; policy / regulations; research; surveys, required to take the project to key project consents and discharge of conditions.
- Full responsibility for successful project delivery including finance; governance; legal; logistics; procurement; project management; project risk & mitigation; scheduling / planning; stakeholder engagement; acquisition/merger; consortium; land acquisition and assembly.
- Parkwind in-house experienced technical team (Turbine, Electrical and Foundation package) was responsible for the development and construction of the offshore grid connections, onshore grid connections, procurement of foundations & turbines as well as for the installation of foundations & turbines
- Full responsibility for QA & QC including auditing; inspection; monitoring, recording and analysis of data and/or production of statistics relating to quality assurance / quality control performance; quality assurance; quality control; quality management systems.
- Parkwind possesses a very competent internal project finance team that worked on financial closing of the project.
- Parkwind follows a close collaboration between the internal engineering and construction teams' approach which allow meeting the most demanding standards and having an extremely efficient problem-solving approach during the construction and operational phase.
- During the follow-up of the different contracts, Parkwind has experienced the importance of adopting a hands-on approach towards its (foreign) subcontractors and contractors by having (local) people on the ground who are closely monitoring the qualitative fabrication process.
- Since 2010 the Parkwind service organization has developed itself as a proven operator for offshore wind assets, by building a full team of offshore wind Operation and Maintenance specialists based in Parkwind`s coastal offices in Oostende supported by Parkwind HQ in Leuven (near Brussels). From this hub, Parkwind is ready to roll out support to any site in Europe and beyond.
- Parkwind is fully responsible for the Production Management, Asset Management, Full Safety and Quality framework, Maintenance Contractor Management, 24/7 Offshore Logistics Management and Control, Maintenance and Operation of the Electrical HV Installations, Specialist Support for the Maintenance of the Balance of Plant (BOP).

ESB – OFFSHORE PROJECT EXPERIENCE

- In 2018, ESB acquired a 12.5% stake in the 353MW Galloper Offshore Wind Farm.
- In 2019, ESB finalised a partnership with Parkwind which spans both the Oriel OFFSHORE WIND Farm and the Clogherhead OFFSHORE WIND Farm.
- In 2019, ESB secured a 50% stake in Neart na Gaoithe ("NnG"), a 450MW offshore windfarm project located off the coast of Fife in south-east Scotland. NnG is being constructed in partnership with EDF Renewables and is expected to be operational in 2024.
- In early 2020, ESB formalised its involvement in the Five Estuaries OFFSHORE WIND Farm. This is in the early stages of development and is an extension site to the Galloper OFFSHORE WIND Farm, and
- In late 2020, ESB acquired a 50% stake in the 1,080MW Inch Cape Offshore Wind Farm off the east coast of Scotland (15km to the east of the Neart na Gaoithe site). Inch Cape secured a CFD contract through the fourth round of the UK government's Contracts for Difference auctions in July 2022, with delivery set for 2026/27.
- In May 2023 ESB acquired a 24.5 per cent interest in Northland Power's ScotWind projects, the fixed-bottom offshore wind farm Spiorad na Mara and the floating wind project Havbredey. Spiorad na Mara is a fixed-bottom offshore wind project, located approximately 5 kilometres off the west coast of Lewis at its closest point with a potential capacity of around 840 MW. The site of the Havbredey floating wind turbine project is located approximately 35 kilometres offshore to the north-west of Lewis. The floating wind farm has a potential capacity of around 1.5 GW.
- In June 2023 ESB and Orsted signed an agreement to jointly develop an Irish offshore wind portfolio. This agreement saw Ørsted become a 50/50 partner in a pipeline of offshore wind development projects off the Irish coast. The partnership has the p
  deliver up to five gigawatts (GW) of renewable energy and complementary renewable hydrogen projects.

ESB OFFSHORE EXPERIENCE - GALLOPER

Galloper Offshore Wind Farm is owned by a consortium led by RWE Renewables (25%), UK Green Investment Galloper Ltd (25%), Siemens' financing arm, Siemens Financial Services (25%), ESB (12.5%) and a fund established by Sumitomo Corporation, Sumitomo Mitsui Banking Corporation and Development Bank of Japan (12.5%). RWE Renewables has led the development and construction of Galloper Offshore Wind Farm and its ongoing operation on behalf of the project partners.

The project was constructed and delivered significantly under budget, 30 km off the Suffolk coast in the UK. Fifty-six turbines spread over 113km2 generate enough energy to power the equivalent of 444,000 homes.

ESB acquired their share in Galloper Wind Farm Ltd (GWFL) to build up knowledge and expertise through an operational wind farm.

ESB input into project decisions via two Directors on the Galloper Board and one Investment Manager. Commercial, operational and technical lessons learned from the project have allowed ESB build up experience which have been incorporated into the development of future offshore wind projects in Ireland and the UK.

ORE Project	Galloper -353 MW Offshore Wind Farm
Location of Project	Approx. 30km off the coast of Suffolk, UK
Project Overview	• 353 MW • 30 KM from shore • Between 27 -36mts depth • 56 Siemens WT-6.0-154. 6.3MW with Power Boost • Powers 444,000 households
Project Timeline	• DCO Submission: 2011 • DCO Award: 2013 • FID: 2015 • Construction phase: Jun'16 – Mar'18 • First power: Nov'16 • Operational phase: Mar'18 – in operation
Project Scope	RWE Renewables has led the development and construction of Galloper Offshore Wind Farm and its ongoing operation on behalf of the project partners. ESB input into project decisions via two Directors on the Galloper Board and one Investment Manager The project has a total installed capacity of 353 MW: - 353 MW, comprising 56 x 6.33MW wind turbines installed on monopile foundations
Current Status of Project	Operational Phase

ESB OFFSHORE EXPERIENCE - NEART NA GAOITHE

NnG is a key UK offshore wind farm project. It is located off the east coast of Scotland, 15.5 km off the Fife coast and covers an area of approximately 105 km2. EDF Renewables acquired NnG in 2018.
In 2019 ESB purchased a 50% stake in the NnG offshore wind farm project from EDF Renewables.

NnG won a Contract for Difference (CfD) in 2015, providing the windfarm with an inflation-linked strike price for the electricity it produces for a period of 15 years. NnG has a capacity of c. 450 megawatts of low carbon energy and will offset over 400,000 tonnes of carbon emissions each year.

Construction of NnG started onshore in November 2019 while work offshore got underway in August 2020. Full commissioning is expected to be completed in 2024.

Key Data	
Counterparty	EDF Renewables UK Ltd
Location	15km off the East Coast of Scotland
Number of Wind Turbines	54 Siemens Gamesa 8.4MW (similar model to Galloper)
Export Capacity	448MW (at metering point)
Energy Output	48% Capacity Factor
Contract for Difference	15years for £129.88/MWh (in 2019 money)
Foundation Type	3 legged jackets with pre-piled pins
Tip Height	208m

ESB OFFSHORE EXPERIENCE – INCH CAPE

Inch Cape Offshore Wind Farm is owned by Inch Cape Offshore Limited, an equal joint venture between Edinburgh based renewable and sustainable energy company, Red Rock Power Limited and Ireland's leading energy company, ESB. In late 2020, ESB acquired a 50% stake in the 1,080MW Inch Cape Offshore Wind Farm off the east coast of Scotland (15km to the east of the Neart na Gaoithe site). Inch Cape secured a CFD contract through the fourth round of the UK government's Contracts for Difference auctions in July 2022, with delivery set for 2026/27.

The Inch Cape Offshore Wind Farm, currently in late-stage development, will see up to 72 turbines located 15 km off the Angus Coast in the East of Scotland and will connect to the national transmission system at Cockenzie, East Lothian. The project will make a significant contribution to meeting the UK's offshore wind target and will be Scotland's largest single source of renewable power when built, generating the equivalent of the annual power needs of more than 1.7m homes. Electricity from Inch Cape will be transmitted via subsea export cables to an existing National Grid Electricity Transmission connection at the former Cockenzie Power Station in East Lothian.

Inch Cape
OFFSHORE LIMITED

SDIC Red Rock Power Limited

ESB Energy for generations

Key Data	
Counterparty	Red Rock Power Limited
Location	15km off the Angus Coast on the East Coast of Scotland
Project Capacity	1,080MW

ESB RECENT UNDERGROUND CABLE PROJECT LIST

220 kV Cable Projects

- Cork Harbour 220 kV Submarine Cable
- Shannon Crossing 220 kV Submarine Cable
- Kilpaddoge-Knockanure 2 220 kV Cable - 20 km
- Belcamp-Shellybanks 220 kV Cable - 13 km
- Belcamp-Finglas 220 kV Cable - 10 km - 110 kV
- Ballyvouskill-Coomataggart 110 kV Cable – 31 km
- Finglas-Dardistown 110 kV Cable – 10 km
- Airton-Inchicore 1&2 110 kV Cable – 8 km

ESB ONSHORE CABLE EXPERIENCE CORK HARBOUR 220 KV PROJECTS

Client: ESB

Location: Ireland

Summary: 570 MVA deep reinforcement project. Two of the first 220 kV (2*1600mm sq XLPE) subsea circuits in the world

Total project engineering and management including:

- Land and submarine cable route engineering
- Marine surveys
- Consenting
- Rating calculations
- Specification preparation and tender enquiry evaluation.
- FAT & Type testing
- Health & Safety Coordination
- Installation supervision
- Commissioning

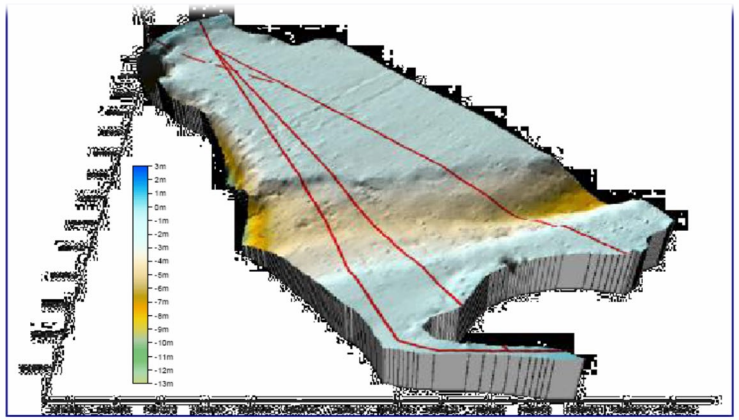


Figure 3 – 3d Schematic View of Survey Area Bathymetry.

ESB ONSHORE CABLE EXPERIENCE
SHANNON CROSSING 220 KV SUBMARINE CABLES PROJECT

Marine

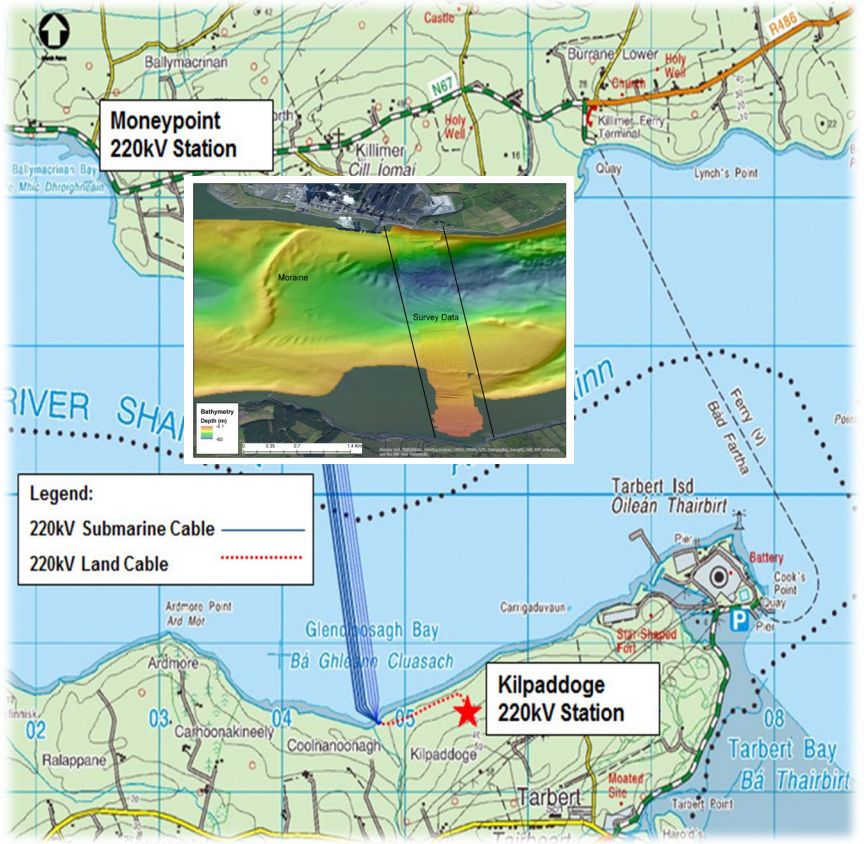
- Detailed route design including marine surveys
- Development of seabed sediment transport models
- including Burial Protection Index (BPI)
- Detailed installation analysis
- Landfall design and coastal protection
- Assessment of geotechnical and geophysical data.

Project Management

- Detailed project scoping, budgets and programming
- PSDP / H&S management
- Technical & Commercial specification preparation including tender enquiry evaluation
- Onshore & offshore installation supervision

Technical

- Detailed rating calculations
- Installation of Brillouin DTS system
- FAT & Type testing
- Commissioning & after laying tests



ESB RECENT SUBSTATION PROJECT LIST

Examples GIS Projects:

- Knockaure 220 kV 2016
- Kilpadogue 220 kV 2016
- Ballyvouskill 220 kV 2016
- Ballynahulla 220 kV 2016
- Castlebaggot220 kV 2018
- Kellystown 220 kV 2022
- Belcamp 220 kV 2024
- Coolnabacky 400 kV (commence construction in 2024)

Examples 220 kV AIS Projects:

- 220 kV Facebook Datacenter 2023

Station Redevelopment Projects – AIS to GIS

- Moneypoint 400/220/110 kV 2019
- Carrickmines 220/110 kV ongoing
- Finglas 110 kV ongoing

PROJECT EXPERIENCE – IMPLEMENTING MITIGATION MEASURES

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

MARINE MAMMAL MITIGATION

Evidence of use of measures as standard mitigation on other offshore wind farms

Beatrice Offshore Wind Farm, Scotland (Piling 2nd April to 2nd December 2017)

- ADDs were deployed 15 mins immediately prior to the commencement of piling.
- Piling utilised a soft start procedure over a period of 20-30 mins, beginning with low frequency, low energy blows.
- Protocols for varying lengths of piling breaks were put in place.
- PAM and marine mammal monitoring were employed.
- No marine mammals were sighted by MMOs or detected by PAM during piling activities.

Moray East Offshore Windfarm, Scotland (Piling 19th May 2019 to 27th February 2020)

- ADDs were deployed 5-10 mins immediately prior to the commencement of piling.
- Piling utilised a soft start procedure over a period of 20 mins, beginning with low frequency, low energy blows.
- Protocols for varying lengths of piling breaks were put in place.
- MMOs and PAM operators monitored a 500 m mitigation zone.
- No acoustic detections during piling activities were recorded. Four visual marine mammal sightings occurred but all were outside of piling activities, ADD activation and mitigation watches.

Research Article - McGarry, T., Boisseau, O., Stephenson, S. & Compton, R., 2017. Understanding the Effectiveness of Acoustic Deterrent Devices (ADDs) on Minke Whales (Balaenoptera acutorostrata), a Low Frequency Cetacean. ORJIP Project 4, Phase 2, S.l.: Carbon Trust.

- Carbon Trust Offshore Renewables Joint Industry Programme Project 4, Phase 2
- Project focused on assessing the efficacy of ADDs (specifically, the Seal Scarer ADD manufactured by Lofitech) as a potential mitigation tool for the minke whale.
- From the results of 15 ADD deployments, the project suggests that ADD can be used as an effective mitigation solution for minke whale to deter them over ranges that would reduce the risk of exposure to harmful noise from piling.
- Together with the results from other field trials, the Lofitech ADD can be considered a successful multi-species mitigation tool for minke whale, harbour porpoise, harbour seal and grey seal.

FOUNDATION INSTALLATION

- The offshore foundations for the Oriel Wind Farm Project require drilling of monopiles into bedrock. Whilst this technique is relatively new it is now being used for a number of offshore wind farm projects.
- For the design of the foundations and installation for the Oriel Wind Farm project, Parkwind contracted DEME offshore group. DEME have successfully designed and drilled foundations in a number of offshore wind farm projects including the St Nazaire offshore wind farm, France (2022) where 73 monopiles were drilled through calcarenite rock.
- The drilling technique is now in use at other offshore wind farms including Le Tréport, France and Jeonnam 1, Korea.
- A significant environmental benefit from drilled foundation installation is the reduction in subsea noise in comparison to fully piled foundations.

DEME

DEME OFFSHORE

DRILLING & EPCI TRACK RECORD

Prepared by: CEKA

February 2024

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DRILLING PROJECTS

SAINT-NAZAIRE | WTG FOU T&I

Bay of Biscay, Saint-Nazaire, France

- **Client:** Éolien Maritime France
- **Project overview:**
  - SOW: 80 x WTG foundations (MPTP)
  - Turbine size: 6 MW
  - Execution period: May 2021 – May 2022
- **Installation overview:**
  - Water depth: 12m – 25m
  - Installation operations in challenging swell conditions
  - Soil conditions: sand, calcarenite, transition layers of sand / calcarenite
  - Different techniques used for MP installation due to soil conditions: Driven MP / Rock-socket drilled MP / Drive-Drill-Drive
  - Drilling and grouting depth: 6m – 25m / Driving depth: 4m - 33m
  - Approx. 60,000m³ rock excavated through bedrock drilling using MODIGA and OFD:
    - OFD (Offshore Foundation Drill) = Specially designed and built drilling machine (MP bottom diam. = 7m)
    - MODIGA (Monopile Offshore Drilling Installation & Grouting Aid) = Designed and built to support the drilling machine during installation
  - Approx. 30,000t grout injected between bedrock and MP
  - Fast-curing grout developed for Saint-Nazaire project specifically (60MPa grout compressive strength)

- **Environmental considerations and mitigations:**
  - Noise mitigation for driven MPs with Air Bubble Ring inside the MODIGA
  - Acoustic deterrence devices (ADD): Keeping marine mammals away with pingers and sealscarers
  - Passive acoustic monitoring (PAM): Buoys placed 500m – 700m away with hydrophones for noise level assessment + visual assessment of marine mammals through spectrogram analysis
  - Not impacting turbidity on-site hence drill cuttings disposal on-site

SAINT-NAZAIRE | OSS T&I

Bay of Biscay, Saint-Nazaire, France

- **Client:** Éolien Maritime France
- **Project overview:**
  - SOW: 1 x OSS foundation (pre-piled jacket) + topside T&I
  - Execution period: August 2021
- **Installation overview:**
  - OSS foundation: Rock socket pre-piled jacket (drill & grout)
  - One piling template designed and built for 3x OSS projects: St. Nazaire, Fécamp, Courseulles
  - Water depth: 25m
  - Soil conditions: Sand, calcarenite, transition layers of sand / calcarenite
  - Pile target depth: around 20m
  - Installation methodology:
    - Sacrificial casing oscillation in seabed
    - Drilling boreholes in casings
    - Inserting and fixing jacket piles (2.3m diameter)
    - Grouting piles with structural grout
  - OSS jacket and topside installation:
    - Jacket: 4-legged; Weight = 1.250t, 26m x 26m footprint
    - Topside: Weight = 2.200t
- **Environmental considerations and mitigations:**
  - Not impacting turbidity on-site hence drill cuttings disposal on-site

FÉCAMP | OSS T&I

English Channel, Fécamp, France

- **Client:** Éolien Maritime France
- **Project overview:**
  - SOW: 1 x OSS foundation (pre-piled jacket) + topside T&I
  - Execution period:
    - Piling: March 2022
    - Jacket + topside: August 2022
- **Installation overview:**
  - OSS foundation: Insert pile for pre-piled jacket
    - Dual function top pile: transfer loads and act as casing for the sediments
    - Grouting with structural grout between insert pile to rock and insert pile to upper pile interface
  - One piling template designed and built for 3x OSS projects: St. Nazaire, Fécamp, Courseulles
  - Water depth: 28.9m (tide at site: 9.1m)
  - Soil conditions: Rock / clay
  - Pile target depth: around 30m
  - OSS jacket and topside installation:
    - Jacket: 4-legged; Weight = 1.300t; 26m x 26m footprint
    - Topside: Weight = 2.200t
- **Environmental considerations and mitigations:**
  - Not impacting turbidity on-site hence drill cuttings disposal on-site
  - Noise mitigation and monitoring

COURSEULLES | OSS T&I

Bay of the Seine, Courseulles-Sur-Mer, France

- **Client:** Éolien Maritime France
- **Project overview:**
  - SOW: 1 x OSS foundation (pre-piled jacket) + topside T&I
  - Execution period:
    - Piling: March 2022
    - Jacket + topside: March 2023
- **Installation overview:**
  - OSS foundation: Drive-drill-drive (DDD) pre-piled jacket
  - One piling template designed and built for 3x OSS projects: St. Nazaire, Fécamp, Courseulles
  - Water depth: 24.6m (tide at site: 7.8m)
  - Pile target depth: around 30m
  - Soil conditions:
    - Smooth surface with gentle slope
    - Stiff to very hard clay
    - Weak to moderately strong limestone
  - OSS jacket and topside installation:
    - Jacket: Weight = 4-legged; Weight = 1.300t; 26m x 26m footprint
    - Topside: Weight = 2.100t
- **Environmental considerations and mitigations:**
  - Not impacting turbidity on-site hence drill cuttings disposal on-site
  - Noise mitigation and monitoring

NOIRMOUTIER | WTG FOU T&I

Bay of Biscay, Vendée, France

- **Client:** Les Eoliennes en Mer Iles d'Yeu et de Noirmoutier

- **Project overview:**
  - SOW: 62 x WTG foundations (MPTP)
  - Turbine size: 8 MW
  - Execution period: start mid 2024

- **Installation overview:**
  - Water depth: 18m – 35m
  - Installation operations in challenging swell conditions
  - MP installation: Rock-socket drilled MPs using refurbished MODIGA and OFD:
    - OFD (Offshore Foundation Drill) = Specially designed and built drilling machine (MP bottom diam. = 7m)
    - MODIGA (Monopile Offshore Drilling Installation & Grouting Aid) = Designed and built to support the drilling machine during installation
  - MP target penetration: up to 28m
  - Soil conditions:
    - Dolomite/dolomitic arenite <30m below seabed
    - Sand > 30m below seabed
  - Fast-curing grout
  - TP installation: bolted + grouted MPTP connection (non-structural grout)

- **Environmental considerations and mitigations**
  - Not impacting turbidity on-site hence drill cuttings disposal on-site
  - Noise mitigation with Air Bubble Ring
  - Acoustic deterrence devices (ADD): Keeping marine mammals away with pingers and sealscarers
  - Passive acoustic monitoring (PAM): Buoys placed with underwater hydrophones for noise level assessment + visual assessment of marine mammals through spectrogram analysis

NOIRMOUTIER | OSS T&I

Bay of Biscay, Vendée, France

- **Client:** Les Eoliennes en Mer Iles d'Yeu et de Noirmoutier
- **Project overview:**
  - SOW: 1 x OSS foundation (pre-piled jacket) + topside T&I
  - Execution period: early2024
- **Installation overview**:
  - Water depth: 27m
  - OSS foundation: Rock socket pre-piled jacket (drill & grout)
  - Pre-piling template refurbished from Saint-Nazaire OSS
  - Installation methodology:
    - Sacrificial casing oscillation in seabed
    - Drilling boreholes in casings
    - Inserting and fixing jacket piles (2.55m diameter)
    - Grouting piles with structural grout
  - Pile target penetration: 16.5m
  - Soil conditions: Weak dolomitic arenite
  - **Environmental considerations and mitigations:**
    - Drill cuttings disposal 5m above seabed at site
    - Marine mammals and noise monitoring

02

EPCI PROJECTS

DEME OFFSHORE EPCI EXPERTISE

Track record: EPCI projects

ARCADIS OST 1 | WTG FOU EPCI

Baltic Sea, Germany

- **Client:** Parkwind NV
- **Project overview:**
  - SOW: 27 x WTG foundations EPCI (TP-less MP)
  - Turbine size: 9.5 MW
  - Execution period: May 2022 – July 2022
- **Installation overview:**
  - Water depth: 39m – 45m
  - MP installation: MPs driven with hydro hammer (with shock absorber and hydro sound damper)
  - MP diameter: 9.4m
  - Max. MP weight: 2.100t; max. MP length 107.5m
  - Secondary steel installation
- **Environmental considerations and mitigations:**
  - Hydro hammer with PULSE option (Piling Under Limited Stress Equipment)
  - Noise mitigation using:
    - Double Big Bubble Curtain (DBBC)
    - Hydro Sound Damper (HSD) net integrated in HLV Orion's Motion Compensated Gripper
  - Acoustic deterrence devices (ADD): Keeping marine mammals away with pingers and sealscarers
  - Passive acoustic monitoring (PAM): Buoys placed with underwater hydrophones for noise level assessment + visual assessment of marine mammals through spectrogram analysis

ARCADIS OST 1 | OSS FOU EPCI

Baltic Sea, Germany

- **Client:** Parkwind NV
- **Project overview:**
  - SOW: 1 x OSS foundation EPCI (MPTP)
  - Execution period: June 2022
- **Installation overview:**
  - Water depth 43.7m
  - OSS foundation: MPTP with bolted MPTP flange connection + non-structural grout
  - MP design: Length = 110m; Weight = 2.100t; Diameter = 9.6m
  - MP embedment depth: 62.9m
  - After MP installation:
    - J-tube cage installation
    - TP installation
    - Bolting + grouting MPTP connection

  - **Environmental considerations and mitigations:**
    - Same as for WTG FOU installation (see previous slide)

SEAMADE | WTG FOU + OSS EPCI

North Sea, Belgium

- **Client**: Seamade NV
- **Project overview:**
  - SOW: 58 x WTG Foundation EPCI (MPTP) + 2x OSS Foundation EPCI (MPTP)
  - Turbine size: 8.4 MW
  - Execution period : September 2019 – January 2020
- **Installation overview:**
  - Water depth: 20 - 30m
  - Pre-sweeping and dredging campaign prior to Foundation installation
  - MP installation: Driven MPs (8m diameter) with Hydrohammer
  - TP installation: Bolted connection + non-structural grout for MPTP connection
- **Environmental considerations and mitigations**
  - Noise mitigation using Double Big Bubble Curtain (DBBC)
  - Acoustic deterrence devices (ADD): Keeping marine mammals away with pingers and sealscarers
  - Passive acoustic monitoring (PAM): Buoys placed at 750m with underwater hydrophones for noise level assessment + visual assessment of marine mammals through spectrogram analysis