Version June 2020

Sustainable Energy Authority of Ireland

National Energy Research, Development & Demonstration Funding Programme

FINAL REPORT

This project has been supported with financial contribution from Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2019, Grant number 19/RDD/439

SECTION 1: PROJECT DETAILS

Project Title	Informing and Mapping the Offshore Renewable Environment (I-MORE)
Lead Grantee (Organisation)	Gavin and Doherty Geosolutions Ltd.
Lead Grantee (Name)	Dr. Paul Doherty
Final Report Prepared By	Dr. Guillaume Michel and Dr. Mark Coughlan
Report Submission Date	20/10/2023

	Name	**Organisation**
Project Partner(s)	Dr. Valerie Cummins Dr. Andrew Wheeler Dr. Jimmy Murphy	University College Cork (MaREI & Eirwind)
	Dr. Shane Donohue Dr. Mike Long Dr. Mark Coughlan	University College Dublin (iCRAG)
	Mr. Ronan O'Toole Mr. Xavier Monteys	Geological Survey of Ireland (GSI)
Collaborators	Mr. Ross McNally	Irish Wind Energy Association (IWEA)
	Mr. Dave Ward	Commissioners of Irish Lights (CIL)

Project Summary (max 500 words)
The transition from a developer-led to a central plan-led model for offshore wind development in Ireland gives the State a more prominent role in the development process through site identification and characterisation. In this regard, the State seabed mapping programme (INFOMAR) provides key baseline geophysical and geological datasets that deliver a wide range of benefits to multi-sectoral end-users such as offshore renewable energy, infrastructure development and environmental monitoring. Under the Sustainable Energy Authority of Ireland (SEAI) National Energy Research Development and Demonstration (RD&D) Funding Programme 2019, Gavin and Doherty Geosolutions Ltd (GDG) were funded to undertake a pilot study to demonstrate the potential for early-stage national survey campaigns to provide baseline data to inform marine spatial planning and optimised offshore wind developments. In collaboration with University College Dublin (UCD), University College Cork (UCC) and the Irish Centre for Research in Applied Geosciences (iCRAG), GDG addressed the following key project objectives: 1. Identify the Critical Data Required for early-stage offshore wind farm development based on European best practice; 2. Gather, Analyse and Interpret existing INFOMAR geophysical data to inform shallow ground conditions and assist with site identification; 3. Plan and Execute a New Survey Campaign using offshore in-situ geotechnical testing that will be informed by the new geophysical data interpretation. This campaign will comprise both geotechnical and metocean data gathering. 4. Generate a new sub-surface conceptual map for the pilot area that can be used to inform the potential for offshore wind energy through a combined suitability, constraint, and hazard analysis. 5. Produce a geotecho-stratigraphic framework and classification for the Irish specific seabed conditions. 6. Develop a framework for (i) marine spatial planning and (ii) the wider offshore wind development process. The I-MORE Project has gathered new offshore site investigation data (early 2022) and integrated it with legacy geophysical data to develop updated ground models for the Irish offshore. These ground models have been interrogated using geostatistical approaches and augmented using machine learning. The outcomes are a set of maps and datasets that can be integrated into marine spatial planning. In addition, techniques, and workflows for applying the methodology elsewhere are put forward. Recommendations are made with regards to future acquisition of geotechnical and geophysical data as well as the application of machine learning.

Keywords (min 3 and max 10)	Offshore Renewables Offshore Wind Marine Resources Marine Spatial Planning LCOE RESS

SECTION 2: FINAL TECHNICAL REPORT

2.1 Executive Summary

The Informing and Mapping the Offshore Renewable Environment (I-MORE) was a collaborative project undertaken by Gavin and Doherty Geosolutions (GDG), University College Dublin (UCD), University College Cork (UCC), Irish Research Centre for Applied Geosciences (iCRAG), Marine Institute (MI) and Geological Survey Ireland (GSI). This project was funded under the Sustainable Energy Authority of Ireland (SEAI) National Energy Research Development and Demonstration (RD&D) Funding Programme 2019. The I-MORE project acted as a pilot study to demonstrate the potential for early-stage national survey campaigns to provide baseline data to inform marine spatial planning and optimised offshore wind developments.

Due to the relative immaturity of the offshore wind sector in Ireland compared to Europe, Irish offshore renewable energy will be a subsidised industry. Offshore wind, in particular, is the only technology with sufficient scale to enable Ireland to meet its renewable energy targets. However, while promoting offshore wind energy and encouraging development, Ireland also needs to be mindful of the cost of this subsidy to the exchequer and therefore we need to ensure a competitive system that minimises the Levelised Cost of Energy (LCOE).

Through the I-MORE project, industry and academic collaborators have conducted a Pilot study with site investigation data from the north Irish Sea in the form of geophysical, geotechnical and geological data that was gathered as part of a desktop study. Following a preliminary site description based on public (INFOMAR) and academic datasets (iCRAG), a dedicated survey was undertaken to acquire additional Cone Penetration Testing (CPT) dataset. After processing and interpretation, and geotechno-stratigraphic model was produced to highlight the spatial variability of ground conditions. Furthermore, technologies to generate synthetic CPTs (ground conditions prediction) with Artificial Neural Network (ANN) were developed and successfully predicted ground conditions at unseen locations, with some limitations for complex glacial sedimentary units.

Overall, the I-MORE project generated state-of-the-art research results:

- Geotechno-stratigraphic model;
- Technologies for synthetic CPTs generation.

And therefore, demonstrated:

- the value of pre-existing datasets (i.e., INFOMAR and academic) to provide information for site characterization at early-stage;
- The benefit of using public data to de-risk site exploration and development.

From this pilot study, the I-MORE project formulated several recommendations:

- Which can act as technical guidelines for public data integration and interpretation;

- To deal with the complex geological unit succession of the Irish Sea were given and discussed in a scientific publication;
- For the generation of synthetic CPTs in challenging geological environment, highlighting the benefits and limitation of the technology are discussed in a second scientific publication;
- To support the state in its OREDP II (Offshore Renewable Energy Development Plan) preparation and selection of DMAP (Designated Maritime Area).

The recent changes in the Irish Offshore Renewable Energy (ORE) development scheme have seen a move from the traditional plan-led model, where developers selected and developed sites of their choosing, to a centralised plan-led approach where the State, through its Department of the Environment, Climate and Communications (DECC), takes initial responsibility for site identification and de-risking through the development process. Within this new regime, there is significant scope for Government state-actors to provide critical front-end data that can significantly de-risk and accelerate the deployment of offshore wind in particular. Within this context, the I-MORE project acted as a key enabler for the reduction in LCOE by providing early-stage site condition information to assist in key decision making for offshore wind development. The value of this information at an early stage in the development process includes recommendations and technical guidelines for:

1. *Optimised Site Selection* – having information at an early stage allows the best possible offshore

   wind sites to be selected, with the best possible chance of reducing LCOE;
2. *Accelerated Development* – providing information at project early stages allows it to curtail the development timeline, reducing costs and bringing forward the time to first generation;
3. *Increased Investment Interest* –reducing the uncertainty associated with the site conditions will encourage greater levels of international investment interest; and;
4. *Reduced Cost of Finance* –uncertainty associated with ground conditions is one of the biggest project risks and adds to the cost of finance: one of the most significant development costs.

With this pilot study, the I-MORE project generated state-of-the-art research results, provided several technical recommendations about data integration, and general recommendations to accelerate Offshore Wind Development in Ireland.

2.2 Introduction to Project

There is increased ambition in Ireland to develop offshore wind as a sustainable energy source, with up to 5 GW of development target by 2030 (DCCAE, 2019). Coupled to that ambition is the need for robust and cost-effective means of assessing the suitability of offshore sites for development. Site investigation and characterisation activities to this end often necessitate geological, geophysical and geotechnical survey techniques, which can be time consuming and costly (e.g. Velenturf et al., 2021). In addition, wind farm projects are covering larger spatial areas to accommodate adequate turbine spacings meaning projects are likely to encounter differing ground conditions across any one site. These ground conditions can vary significantly vertically and laterally depending on an area's geological history. This is especially true for formerly glaciated terrains where episodes of glaciation can result in highly heterogeneous sedimentary cover through a range of depositional environments, as well as deformation and consolidation of sediments through ice-loading (e.g. Cotterill et al., 2017; Coughlan et al., 2018; Dove et al., 2017; Emery et al., 2020; Van Landeghem and Chiverrell, 2020).

With increased national targets for offshore wind in many countries, there has been a move towards centralised models of planning and development whereby the state takes on the responsibility of early-stage site identification and initial scoping activities (International Energy Association - Renewable Energy Technology Deployment, 2017). Critical to such models is a firm understanding of the seabed and its structure, as well as the provision of site investigation data (e.g. Barrie and Conway, 2014). The extent of these data can vary, but an important role is played by national seabed mapping programmes, who can deliver spatially extensive geophysical data (e.g. Guinan et al., 2020). The synthesis and interpretation of these data, when supplemented with ground truthing data can offer a robust constraining exercise for seafloor conditions related to offshore renewable energy development (e.g. Coughlan et al., 2020; Heath et al., 2017; Nyberg et al., 2022; Peters et al., 2020). However, constraining the sub-surface geological variability and its engineering implications, requires geotechnical parameters at depth (e.g. Le Bot et al., 2005) in order to avoid major fiscal implications due to poor site selection in challenging ground conditions. Despite the importance of marine spatial planning and strong underpinning of geotechnical and geological data in the development of offshore renewable energy, like offshore wind, both are generally poorly integrated with GIS based research studies (Peters et al., 2020b).

In characterising offshore areas for site selection and de-risking, site investigation data can provide information that is spatially extensive but lacking resolvable geotechnical or geological information (e.g. geophysical and seismic survey data), or can provide detailed information (e.g. borehole and cone penetration testing) that is limited to specific locations (OSIG, 2022). A key component is integrating these data to optimise their respective benefits (Vardy et al., 2017). At present, the preferred tool for site investigation to provide detailed geotechnical data is the cone penetration testing (CPT) approach (Andersen et al., 2008; Lunne et al., 1997; Robertson and Cabal (Robertson), 2009). Although it does not retrieve a sample, it is a robust and reliable tool with which to assess sediment behaviour and garner key information on geotechnical parameters related to strength and stiffness. Extensive research has allowed for these measured parameters to be empirically related to known sediment classes and for the development of soil behaviour charts to aid with prediction where ground truthing may not be available (e.g. Eslami and Fellenius, 1997; Robertson, 2009, 1990; Robertson et al., 1986; Schneider et al., 2008). Often, these charts are charts used on a first instance to characterise stratigraphy at a site. Various iterations have since been developed to account for local sediment types that don't fit traditional classification schemes (Cai et al., 2011; Feng et al., 2022; Yin et al., 2021). In order to meaningfully extend geotechnical and geological data beyond point locations, a number of interpolation and extrapolation approaches have been employed including kriging (Lee et al., 2011; Liu et al., 2021; Wang et al., 2017), inverse distance weighting (Prins and Andresen, 2021; Wang et al., 2017), co-kriging (Sauvin et al., 2019; Xie et al., 2022) and machine learning (Carpentier et al., 2021; Rauter and Tschuchnigg, 2021; Sauvin et al., 2019; Zhao and Wang, 2020).

Under the I-MORE Project, site investigation data from the north Irish Sea in the form of geophysical, geotechnical and geological data was gathered as part of a desktop study (Work Package 2) and a dedicated survey (Work Package 3). The data from Work Package 3 comprised in-situ geotechnical data collected using CPT in a formerly glaciated area that comprises glacial deposits and contemporary (Holocene age) marine sediments. The former are found extensively in offshore northern European (e.g. Coughlan et al., 2018; Le Bot et al., 2005; Nyberg et al., 2022), whilst the latter are generally found worldwide in a variety of settings (e.g. Bhattacharya et al., 2017; Hanebuth et al., 2015; Long et al., 1986; Paul and Jobson, 1991; Porz et al., 2021). In this particular study, CPT data were analysed to establish a stratigraphy based on grouped patterns of values reflecting major lithological changes. Further analysis was carried using soil behaviour type (SBT) classifications to assess their applicability to Irish deposits. This CPT-based geotechnical stratigraphy was then compare to the existing sub-surface stratigraphic framework previously developed within the I-MORE project (see Michel et al., 2023) in order to carry out a geological evaluation. The objective is to assess the applicability of such techniques in providing reliable ground condition information that can be used to constrain the lateral and vertical variability in geotechnical behaviour of the subsurface. This information can then be used in early-stage site identification and risk characterisation studies where available site investigation data may be limited or sparse. In this study, efforts were made to interpolate geotechnical data between investigated locations in a GIS for an area of strong vertical and lateral variability, comprising soft marine sediments and heterogeneous glacial deposits. Results have shown the applicability of these techniques in certain units, and how they can generate spatial data that can be used as part of multi-criteria GIS based marine spatial planning exercises.

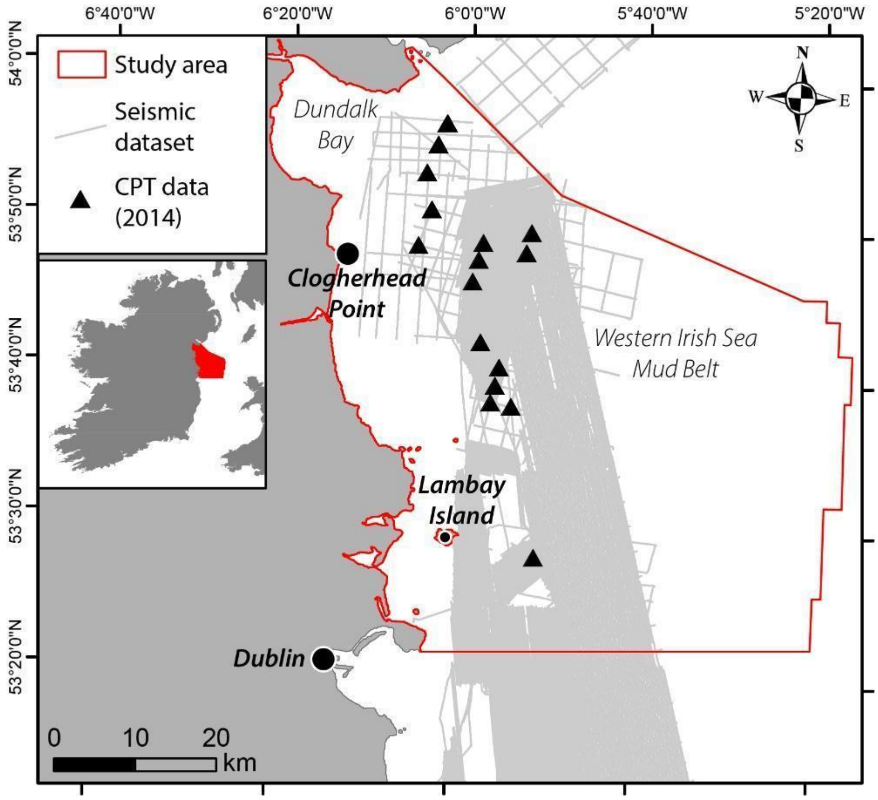

Figure 1: Location map of the seismic dataset explored within the framework of I-MORE WP2 and CPT data from academic datasets.

2.3 Project Objectives

The key objectives of the I-MORE project are as follows:

1) Identify the Critical Data Required for early-stage offshore wind farm development based on European best practice and in particular interrogating the data available in those countries that have managed to reduce LCOE and achieve zero subsidy rates for offshore wind auctions.

2) Gather, Analyse and Interpret existing INFOMAR geophysical data (including shallow subbottom seismic that has been collected through historical INFOMAR survey campaigns). This data is currently raw and archived within the GSI but could be processed to inform shallow ground conditions and assist with site identification. This I-MORE project will leverage the survey work already completed to get best value out of the existing data;

3) Plan and Execute a New Survey Campaign that will be informed by the new geophysical data interpretation. This campaign will comprise both geotechnical and metocean data gathering. The geotechnical data shall be obtained through offshore CPT testing, combined with vibrocore measurements;

4) The new geotechnical data will be integrated with the legacy geophysical data to develop a new sub-surface conceptual map for the pilot area. This map output can be used to inform the potential for offshore wind energy through a combined suitability, constraint and hazard analysis.

5) The final output will be presented as a geotecho-stratigraphic framework and classification for the Irish specific seabed conditions.

6) A framework for (i) marine spatial planning and (ii) the wider offshore wind development process will be presented that could utilise the existing study information to reduce LCOE.

7) Finally, this pilot study will be adopted as a test study to determine whether this approach should be rolled out on a national basis as part of an extension to the existing INFOMAR remit.

I-MORE will deliver a novel dataset, which will be interpreted and integrated with existing data to provide valuable input to the offshore wind energy development process.

In addition to the technical output, this project will bring together the key stakeholders and actions in the business and establish an "ideal case" for the future of offshore wind energy in Ireland. This project will provide guidance on how much data should be provided publicly for the optimum reduction in LCOE. This project will leverage existing work undertaken by EiRWIND in relation to the consenting and development process and regulatory framework and will also build on work completed by the iCRAG EASTWIND project which focuses on geohazards in the Irish Sea. This project is supported by the Geological Survey and the Marine Institute, which offers real potential to disseminate the results to the wider offshore community in Ireland. **As this is a pilot study, it is intended that following successful completion of this work, a similar approach will be rolled out on a national basis to inform both fixed and floating offshore wind developments.**

Table 2.1 – Summary of Project Objectives

No:	Objective Description:	Delivery Timeline:
1.	Renewable Data Requirements	Month 4
2.	Survey Site Identification and Characterisation	Month 13
3.	Survey Planning & Execution	Month 23
4.	Sub-surface Conceptual Model	Month 27
5.	Geotechno-stratigraphic Framework and Classification	Month 32
6.	Marine Spatial Planning Zonation	Month 32
7.	Pilot Study	Month 36

2.4 Summary of Key Findings/Outcomes

Through seven work packages, the I-MORE project completed an entire Pilot Study on a site located in the Northern Irish Sea, from the identification of the key geological and geotechnical information required to boost the development of offshore wind energy in Ireland and reduce the levelized cost of energy to the generation of a geotechno-stratigraphic model for the Northern Irish Sea established from public and academic dataset. It is with the successful acquisition of high-quality geotechnical data in 2022, data quality control and analysis, that the new cone penetration testing dataset was used to inform the geological model and improve the geological knowledge in the Northern Irish Sea. This novel model was published in a high impact peer reviewed journal and currently represent a state-of—art item for geological research in the Northern Irish Sea (see innovation 1).

Along with the geotechno-stratigraphic model (Figure 2), an innovative method to predict ground conditions was developed under the form of synthetic CPTs (Figure 3), generated with an Artificial Neural Network specifically developed for this task (see innovation 2). Nowadays, these methods represent the next generation of tools to be used for offshore site characterization, and the I-MORE project successfully delivered initial results with several recommendations and guidelines, to help better understand the application range and limitations of synthetic CPTs.

Those research outcomes, paired with the technical assessment of required input data, lessons learned from data acquisition and processing, and a comprehensive analysis of the current Offshore

Wind Development direction in Ireland, were integrated to deliver effective recommendations (summarized in section 2.6). Those recommendations provide Ireland's policy makers, research communities and industry, furthered knowledge and practice that are directly usable to effectively accelerate Offshore Wind Development in Ireland, while de-risking it by integrating all existing knowledge and therefore reducing the levelized cost of energy.

- **Innovation 1:** Geotechno-stratigraphic model *(achieved)*.

  A geotechno-stratigraphic model based on geophysical and geotechnical data integration has been produced (Figure 2). As part of a submitted publication in a peer-reviewed journal, it will help refine current understanding of the ice sheet dynamics during last glaciation/deglaciation (Figure 2).

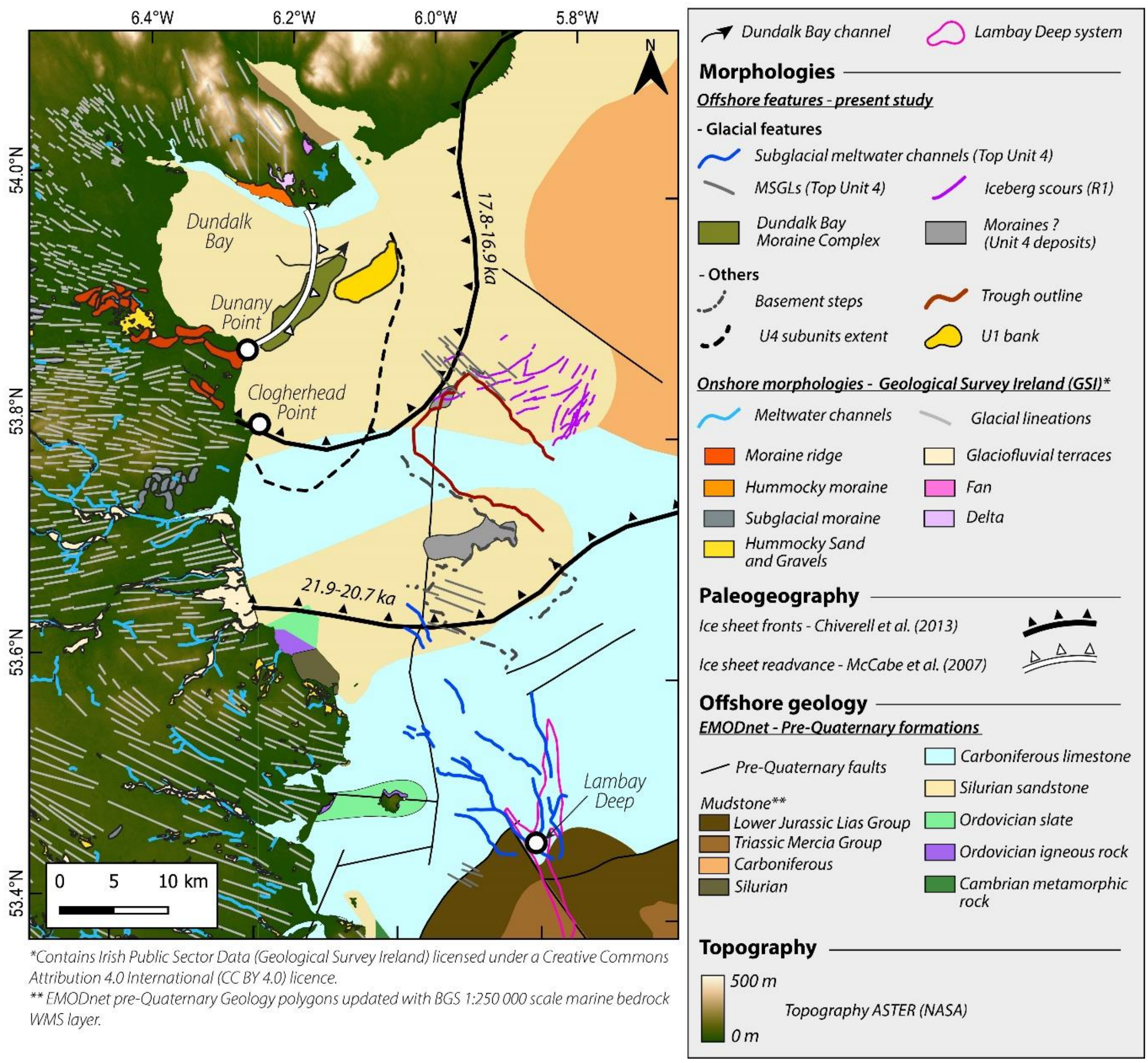

Figure 2: Synthesis map showing mapped geological and geomorphological features within the I-MORE study area from Michel et al. (2023).

- **Innovation 2:** Synthetic CPT generated using Machine Learning method *(achieved)*.

  Synthetic CPT generation using various methods, from interpolation to machine learning, is now considered as the next step for offshore ground modelling. When dealing with limited amount of data, machine learning is a promising alternative to existing methods. The generation of synthetic CPT using Artificial Neural Network has been performed using an existing CPT dataset as training. Several synthetic CPT profiles have been generated using limited amount of input variables (coordinates, bathymetry, final investigation depth), with successful overall results (Figure 3).

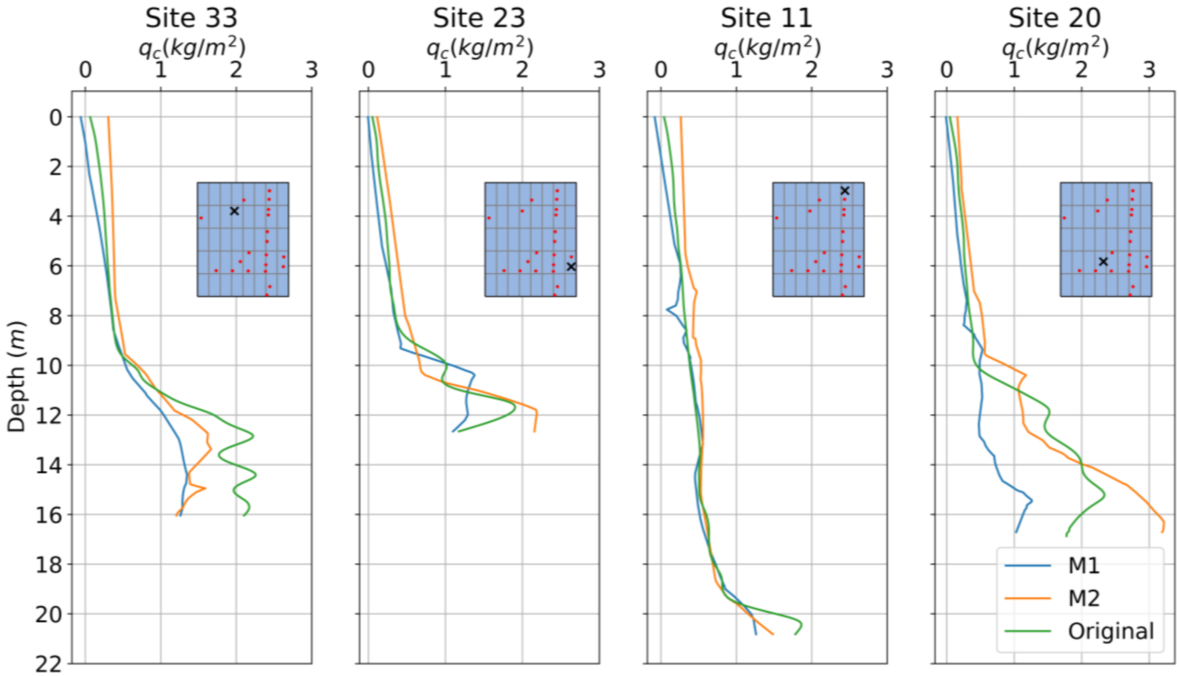

Figure 3: Comparison of synthetic CPT profiles with smoothed raw data.

2.5 Project Impact

During the timeframe of the I-MORE project, Ireland moved towards a plan led system for offshore wind with development sites to be selected by the State. In this recent context change, the main findings and outcomes of this project provide crucial guidelines and recommendations for data integration, processing and interpretation, to accelerate Offshore wind development and effectively de-risk site selection in a complex offshore geological context. Furthermore, the integration of pre-existing datasets (i.e, INFOMAR and academic datasets) was proven to be effective in assessing ground conditions at early stages of site selection, and therefore extremely valuable for the research community, developers, and the Irish state. These directly benefit national policy objectives, SEAI's remit and the Irish Energy Sector.

Moreover, the I-MORE project formulated additional recommendations for the three key objectives of The National Spatial Strategy for Offshore Wind:

- Assessing the resource potential for ORE in Ireland's maritime area.
- Providing an evidence base to facilitate the future identification of areas most suitable for the sustainable deployment of ORE in Ireland's maritime area.
- Identifying critical gaps in marine data or knowledge and recommend prioritised actions to close these gaps.

These recommendations will directly impact and support DECC in its plan led development effort and drafting of the National Spatial Strategy for Offshore Wind document. However, GDG is aware that these objectives may change with the publication of the draft National Spatial Strategy for Offshore Wind

In addition to the impact for Irish Offshore Wind development, the I-MORE project technical outcomes are expected to benefit the international community. Recommendations about data integration and guidelines together with the other recommendations can be used in other countries to help integrate national databases into the sites selection process. Developments made on synthetic CPT generation are also expected to benefit the research community and industry by highlighting the value, but also the limitations, of such technologies.

2.6 Recommendations

Considering the outcomes of the I-MORE project, several recommendations can be formulated:

a) **A more holistic view of Marine Spatial Planning is needed** going forward that avoids any one driver controlling the process of locating offshore wind farms. The first DMAP area off the South Coast in the Celtic Sea has largely been derived as a response to the availability of an up to 900MW grid capacity spread across two nodes off the South Coast. Whilst the availability of grid is clearly a key consideration for the location of offshore wind farms, it should not be the primary consideration in advance of a wider spatial planning exercise. The Eirgrid publication "*Shaping our Electricity Future*" clearly identified the availability of grid capacity ahead of the DMAP process for Phase 2 and this has largely dictated the location of the first DMAP to be announced. Going forward we would recommend a more holistic constraint mapping exercise that gives consideration to the offshore technical constraints in parallel to the available grid capacity in order to identify those areas that are best suited for offshore wind. It may be necessary to build out the grid infrastructure and undertake some priority investment as soon as possible such that there is additional grid capacity available in the areas most suited to ORE rather than potentially having to develop ORE in areas that sub-optimal as a result of those areas being the only locations with available capacity (which could be used for other purposes, e.g., onshore wind/solar).

b) As the Irish market is relatively immature with respect to offshore wind energy generation and there is a need to build out significant capacity before 2030 as well as additional capacity in the subsequent decade, we must **focus on maximising the volume of fixed offshore wind** that can be brought on stream. There is a widespread recognition of the long-term floating ambition off the West coast, however floating wind energy has yet to be proven at industrial GW scale. Therefore, Ireland has a more immediate opportunity to develop offshore wind using fixed technology that can be readily deployed at scale in the immediate future with less cost and lower programme risk. This necessitates a focus from a Marine Spatial Planning perspective to carefully review the bathymetry with a view to identifying all possible areas to deploy fixed bottom offshore wind.

c) To help inform the above identification of sites suitable for fixed wind and recognising that technology is constantly evolving, we recommend undertaking a technology readiness assessment to determine the spatial constraints driving fixed versus floating wind. This technology review should consider the most up to date status of the industry as well as the potential for evolution in foundation, turbine and vessel trends in the coming years.

d) Marine Spatial Planning (MSP) needs to take into account the technical viability of offshore wind and the impact of offshore conditions on the CAPEX and OPEX. The selection of offshore wind sites should start with those zones that are easiest to deliver using available technology. Ireland should consider adopting an LCOE modelling exercise on a national basis to look at spatial cost modelling.

e) The draft OREDP II report published earlier in 2023 ignores many of the key considerations and appears to be overly focused on floating technology, in contradiction to the tagline used of "*the right technology in the right places*". The re-draft of the OREDP II (The National Spatial Strategy for Offshore Wind) needs to give much more detailed consideration to all available data sources and needs to include a more transparent view of the model used to consider the hard and soft constraints.

f) Geological constraints and geohazards including the presence of bedrock within the zone of influence of the foundations should be a key consideration for MSP and DMAP boundary selection. This should be reflected in the National Spatial Strategy for Offshore Wind document.

g) National Marine Planning Framework gives specific mention to both green hydrogen and Carbon Capture & Storage – both of these technologies have the potential for subterrain storage in depleted reservoirs offshore and while not the focus of this particular study, there is merit in undertaking a dedicated study to examine this potential. The potential for offshore subterrain hydrogen storage could play a key role in the joint development of offshore wind for green hydrogen generation and therefore there may be a linked MSP objective to co-locate future offshore wind DMAPs with areas capable of storing hydrogen.

h) The outcome from I-MORE has identified that the INFOMAR data available to date requires significant rework, processing, and interpretation to help inform offshore wind and MSP decision making and this ideally requires knowledge of the offshore wind development process. We strongly recommend that the state continues to collect data to advance our knowledge of the maritime environment, in particular the collection of data linked to subsurface conditions that allow bedrock to be profiled. However, the interpretation of this data should ideally be done by industrial actors with experience in data interpretation for offshore wind development that will ultimately use the datasets.

i) The I-MORE project also highlighted that the state could go further with respect to the data collection and utilise state vessel assets for the collection of geotechnical data such as the CPT testing completed as part of this project.

j) As we move toward a plan led model, the more data that can be provided by the state ahead of an auction, the better. Increased data will help inform the MSP process and ensure the optimum sites are being selected by the state, however the increased knowledge about the site will also provide the developers with confidence about the conditions and de-risk the site ahead of an auction, leading to more competitive results.

2.7 Conclusions and Next Steps

With this pilot study, the I-MORE project generated state-of-the-art research results, provided several technical recommendations about data integration, and general recommendations to accelerate Offshore Wind Development in Ireland.

The main conclusions have been outlined in Section 2.4 and Section 2.6. The methodologies have been proven to be suitable and valuable to integrate public dataset more effectively into site geological characterisation process. Outcomes of this pilot study demonstrated the benefit of integrating pre-existing datasets to de-risk site selection and therefore, its direct impact for DMAP boundary selection as part of the National Spatial Strategy for Offshore Wind.

An important next step would be to undertake a similar study to further the knowledge on synthetic CPT generation. In a context of challenging offshore ground conditions, the generation of synthetic CPTs, which is seen as the next generation of tools to de-risk site development, requires further testing on an adjacent site and with similar dataset. This is particularly relevant to the heterogeneous glacial deposits found offshore of Ireland, that are likely to be encountered in the majority of offshore wind farms to be developed in Irish waters.