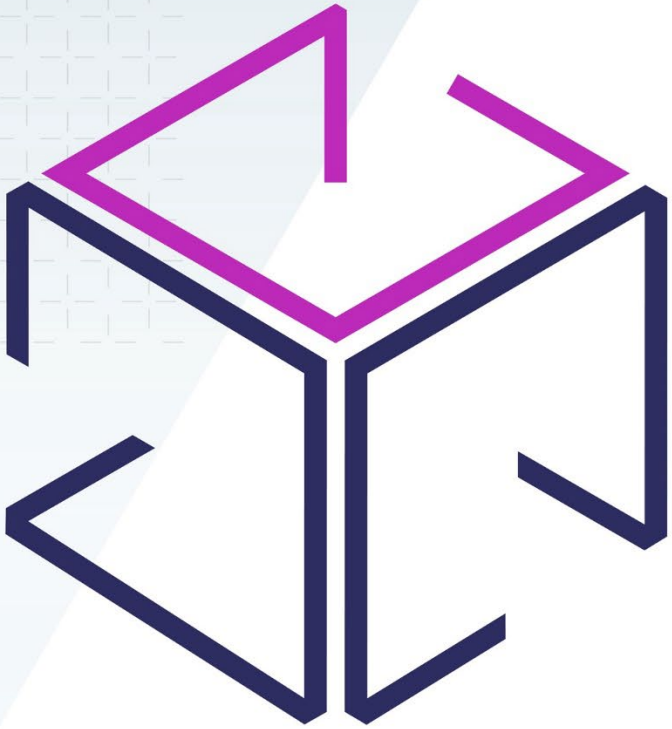
Workforce Foresighting Hub



Automated Welding for Offshore Wind Flotation Structures

Interim Report: Workforce Foresighting Cycle Output

CATAPULT Offshore Renewable Energy

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Acknowledgements

The Workforce Foresighting process integrates data from the following international data sets:

IfATE – Institute for Apprenticeships and Technical Education, England

ESCO – European Skills, Competencies, Qualifications & Occupations, EU

ONet – Occupational Networks Online, USA

In accordance with licence and publishing requirements of these organisations for the use of their data sets, the Workforce Foresighting Hub team states that –

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The ESCO data is used in accordance with the EUROPEAN UNION PUBLIC LICENCE v. 1.2 EUPL © the European Union 2007, 2016

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Any errors, omissions and incorrect data are the responsibility of the Workforce Foresighting Hub team, and all queries should be addressed to info@iuk.wf-hub.org

The method and process used in the Workforce Foresighting process is under development and there may be errors and omissions in the data provided.

This report was produced following workshops undertaken 2025 Q1 using the data set and tools available at that time.

Executive Summary

Workforce Foresighting is a national initiative funded by Innovate UK and deployed through the Innovate UK Catapult Network. Workforce Foresighting is a systemic approach to planning ahead and anticipating future skills and capability needs associated with new technologies and government transformation targets. It involves identifying and understanding the skills required for tomorrow's jobs, ensuring our education and training systems are prepared so that our workforce is ready to adopt new technologies and support future industrial growth.

This interim report outlines findings from the 'carrying-out' phase of a workforce foresighting study on "Automated Welding of Offshore Wind Flotation Structures". The study is sponsored by RenewableUK and conducted by the Offshore Renewable Energy Catapult in collaboration with the Workforce Foresighting Hub.

The study considers the organisational capabilities needed in an alternative production methodology where manual welding of steel sections for the 'floaters' – structures that are used to provide the floating foundation for floating offshore wind turbines – is augmented or replaced by robotic / automated welding equipment.

Within this report, participants and stakeholders can review the developed capability sets and prototype future occupational profiles ('FOPs') before the next phase of work. The appendices provide further information about workforce foresighting, selection of the topic, and provide links to an online "Visualisation Site" for exploration of data generated during this study.

Participants and Stakeholders

The following organisations participated in the carrying-out phase of this foresighting cycle:

Organisation	Technologist Group	Employer Group
The Offshore Renewable Energy Catapult	o	o
Marine Power Systems	o	o
Global Energy	o	o
The Welding Institute (TWI)	o	o
Babcock International	o	
Hutchinson Engineering	o	o
Serimax	o	o
Smulders	o	
The National Manufacturing Institute of Scotland (NMIS)	o	o

Key stakeholders in the foresighting cycle are:

Role	Purpose	Stakeholder
Challenge Sponsor	Person or organisation requiring the outputs of the foresighting process to support decisions to act on education and training.	RenewableUK: Jane Cooper, Director of Offshore Wind
Challenge Convenor	Organisation that identifies and brings together stakeholders to define the Challenge, Sponsor and take part in foresighting.	ORE Catapult: Tony Quinn, Operations Director
Foresighting Champion	Person with authority and influence to convene foresighting interest within the organisation and with its stakeholder and partner bodies.	ORE Catapult: Danielle Portsmouth, Future Skills Manager
Foresighting Coordinator	Person who will manage the acquisition of project information, facilitate topic selection, recruit and organise participants, and author reports.	ORE Catapult: Paul Hatchett, Consultant – Future Skills

Results of the "Carrying Out" Phase

The workforce foresighting workshops and surveys identified 124 capabilities relevant to the topic. Of these capabilities:

- 96 capabilities exist already in the UK IfATE standards; and
- 28 capability statements were newly defined by the study.

The capabilities are grouped into eleven future occupational profiles ('FOPs') in the following areas of practice:

- Design of offshore wind structures to enable and support automated welding.
- Development of automation and welding technology.
- Implementation and operation of automated welding technology during production.

The purpose of the FOPs is to indicate coherent groups of capabilities that can be used as a basis in skills analysis, job design, education / skills curricula. The FOPs are not job descriptions, and it is possible that one job may encompass parts of several FOPs or specialise into part of only one FOP. These resulting FOPs now form the basis for ongoing discussions and the "causing action" phase of workforce foresighting.

Next Steps

In the next phase of the foresighting cycle ORE Catapult will work with stakeholders to identify and initiate actions to close the potential future skills gaps identified through foresighting, considering the volume of likely roles determined by forecasting. This work will include:

1. Incorporating feedback from industrial participants and other reviewers of the future occupational profiles and capability sets.

2. Supporting ORE Catapult and The Welding Institute in the EPSRC funding application "Advanced Automated Welding for Wind Energy", providing input on skills development and role impacts *(completed)*.

3. Developing forecasts that help to understand component volumes and the expected role numbers.

4. Working with further and higher education partners, as well as industry training organisations, to identify potential course module content – based on foresighting and forecasting.

5. Identifying a champion for development of automated welding skills for the offshore wind sector.

6. Evaluating the opportunity for further foresighting studies in floating offshore wind structures.

Nomenclature

AI	Artificial intelligence (in the case of foresighting, the 'GPT4' large language model, used to analyse and match capability statements and standards).
CoE	Centre of Excellence
CPD	Continuing professional development
DESNZ	The UK Government's Department for Energy Security and Net Zero.
FE	Further education
FF	Fit Factor: The degree to which the capability statements within an Existing IfATE course definition fit a given future occupational profile (from foresighting). A higher Fit Factor indicates a closer match.
FOP	Future occupational profile.
GW	Gigawatts
GVA	Gross value added
HE	Higher education
IfATE	Institute for Apprenticeships and Technical Education – see https://www.instituteforapprenticeships.org/
LLM	Large language model
NQF / SQF	National / Scottish Qualification Framework
NMIS	National Manufacturing Institute Scotland
ORE Catapult	The Offshore Renewable Energy Catapult, part of the UK Catapults network of research and technology organisations, established and funded by Innovate UK to accelerate technology and capability in key industrial sectors, and act as a bridge between academic research and industry.
OWIGP	The UK's Offshore Wind Industrial Growth Plan (RenewableUK, 2024)
P-FOP	Prototype future occupational profile. Synonymous in most contexts with FOP.
R&D	Research and development
RTO	Research and technology organisation (e.g. ORE Catapult)
SF	Surplus Factor: The degree to which the capability statements within an Existing IfATE course definition are not contained within a given future occupational profile (from foresighting). A lower Surplus Factor indicates a closer match.
TRL	Technology readiness level: A system used to measure and describe the maturity level of a technology in a manner that enables consistent comparison between different types of technology.
TLP	Tension Leg Platform
WFH, WF-Hub	Workforce Foresighting Hub. The central team based at the Manufacturing Technology Centre (part of the High Value Manufacturing Catapult) that develops and deploys the workforce foresighting methodology, via the UK Catapult network.

Contents

Figures and Tables

1. Introduction

1. Introduction

1.1 Purpose of the Interim Report

This interim report is a summary of output from the "carrying-out" phase of a workforce foresighting study on "*Automated Welding for Offshore Wind Flotation Structures*". The study is sponsored by RenewableUK and conducted by the Offshore Renewable Energy Catapult, supported by the Workforce Foresighting Hub.

The report is intended principally for participants and interested stakeholders to review and access the capability sets and prototype future occupational profiles ('FOPs') developed by the study so far. This provides an opportunity for comment, before the "causing action" phase of the study. FOPs are intended to support industry and the training / education sector in the design of roles and course content, but they are not intended as prescriptions for job descriptions or specific course modules.

The report briefly summarises the foresighting topic and its selection, presents the future occupational profiles, and provides the capability sets within the Appendices. The appendices to the report also contain further information about the workforce foresighting process, and links to an online visualisation tool, where the generated data can be viewed in various ways.

1.2 Background to Workforce Foresighting

The report "Manufacturing the Future Workforce" (Collier et al., 2020) recommended the Skills Value Chain as an approach to avoid shortfalls in workforce capabilities relating to future innovations (see Figure 1). This is the genesis of the workforce foresighting programme, which is sponsored by Innovate UK and delivered through the Innovate UK Catapult Network.

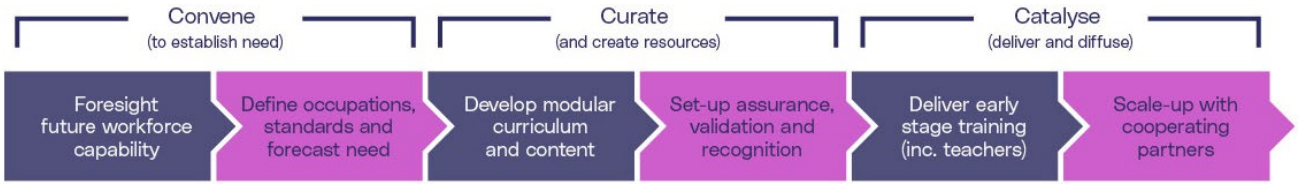

Figure 1: The Skills Value Chain

The first step of the skills value chain is to "*Foresight future workforce capability*": This calls for technology, industry, education, and training partners to convene using government as a focal point, to "*foresight and articulate future skills needs, standards and qualifications associated with emerging technologies*" (Collier et al., 2020).

1.3 Workforce Foresighting - Process Overview

The core of workforce foresighting is convening three groups of relevant specialists to conduct structured, Delphi-style, facilitated workshops to capture and discuss the set of organisational capabilities that will be required to respond to and exploit technology innovation.

Organisational capabilities are captured using a bespoke classification that has been developed by the Workforce Foresighting Hub. The classification uses a structured common language to enable cross sector and cross centre collaboration and integration of data. Additionally, the classification enables data from a number of other national and international open-source workforce datasets to be integrated through the same common language. The data is held in a cloud based "data-cube" that is dynamically growing as each workforce foresighting cycle adds to the shared data relating to future workforce capabilities.

Using cutting edge AI and Large Language Model data tools, the data-cube is used to undertake detailed analysis to 'map' future workforce capability requirements against the current education and training provision to identify where existing provision can be used and where new provision, CPD or qualifications are required.

As an agile development project, the Workforce Foresighting Hub team are constantly evolving and improving the detailed workshop process and workshop approach, but always consists of the following stages:

Considering – Clarifying the Challenge to be met (the 'what' and the 'when') and collating solutions (the 'how') as foresighting topic suggestions align with strategic priorities

Identifying – Gain clarity and consensus about the solutions to be put forward – make the case for foresighting

Preparing – The convening of specialists and scheduling of workshops

Carrying out – Run foresighting workshops with experts, collate and analyse data

Communicating – Insights, findings and recommendations gathered from all research in report

Causing action – The driving of action based on the recommendations (promoting progress down the rest of the skills value chain) built on the findings and recommendations of foresighting

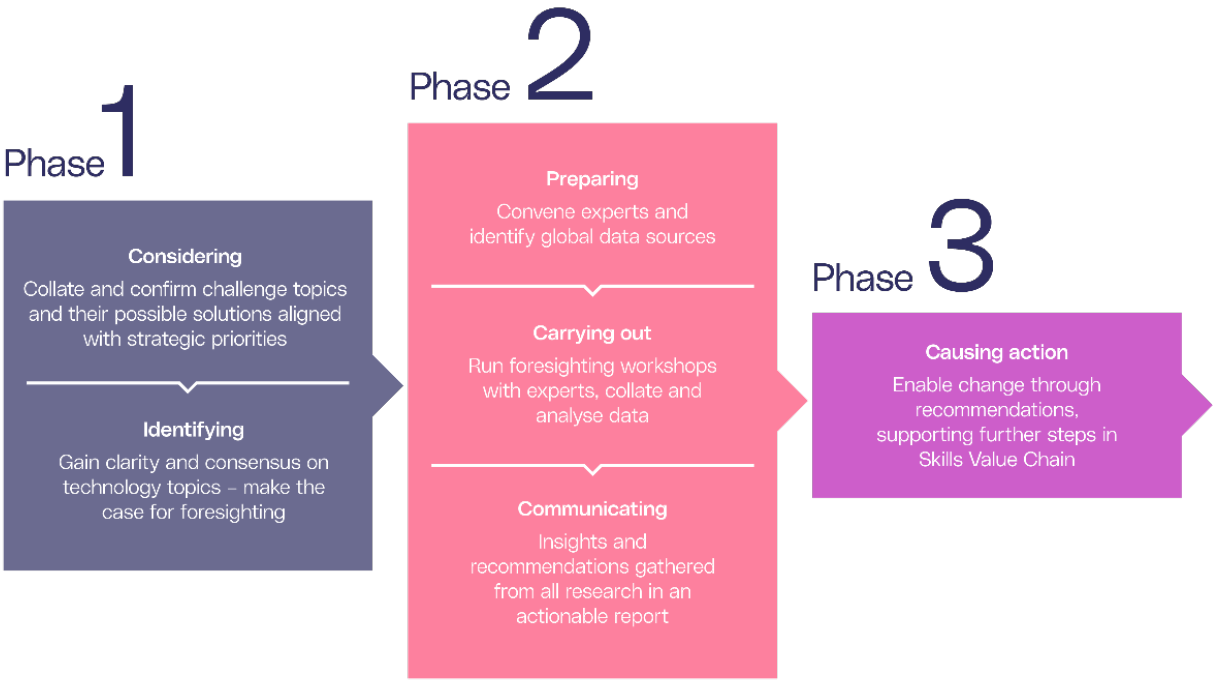

Figure 2 - The workforce foresighting process

1.4 Foresighting vs Forecasting

Although this study is focussed on workforce foresighting (capabilities required) it is important to keep in mind parallel findings from forecasting (required capacities and numbers). ORE Catapult is working with the Department for Energy Security and Net Zero ('DESNZ') and Innovate UK to make assessments and maintain thought leadership around offshore wind installation targets and the implications on educators, industry, and sector bodies. Forecasting, alongside foresighting, provides vital input to the sector, feeding into recruitment and development targets for employers, and consideration of economic class sizes and recruitment targets for educators. However, it is beyond the scope of the foresighting study to carry out independent forecasting, and as such readers should refer to referenced studies for detail on forecasting

2. Defining the Foresighting Challenge

2. Defining the Foresighting Challenge

The foresighting challenge, technologies and topics were identified during a combined 'consider-identify-prepare' phase. A summary of the approach is provided here, but greater detail is set out in the report "Future Skills Needs in UK Offshore Wind: Workforce Foresighting Cycles 3-5 Activity Zero" (Hatchett, 2025).

2.1 Positioning and National Context

According to the UK's Clean Power Action Plan 2030 (Department for Energy Security and Net Zero, 2024), power generation from offshore wind is a vital part of the UK's future energy security and achievement of CO_2 reduction targets. The UK has a target of 43-50GW of power from offshore wind by 2030. Alongside nuclear, this is seen as the backbone of a clean electricity system in the UK. The gap between current installed capacity and future targets is illustrated in Figure 2, below.

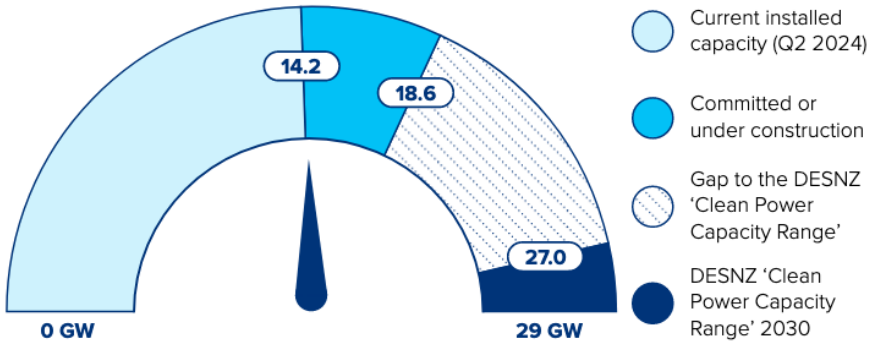

Figure 3 - Offshore Wind installed capacity vs 'Clean Power Capacity Range' in 2030 (Department for Energy Security and Net Zero, 2024)

The need for new technologies and capabilities to support this increase in the UK's installed offshore wind generating capacity, is the top-level challenge being addressed through ORE Catapult's workforce foresighting studies.

2.2 Topic Selection Approach

The foresighting topic of "Automated Welding for Offshore Wind Flotation Structures" has been selected through the following approach:

1. A detailed review of the UK's "Offshore Wind Industrial Growth Plan" (RenewableUK, 2024) to identify focal technology areas for foresighting.

2. Review of the UK's "Clean Power 2030 Action Plan" (Department for Energy Security and Net Zero, 2024) and the Energy Skills supplement to better understand the strategic landscape.

3. Review and shortlisting workshops with lead technologists from the Offshore Renewable Energy Catapult ('ORE Catapult').

2.2.1 Overview of the Offshore Wind Industrial Growth Plan

The Offshore Wind Industrial Growth Plan ('OWIGP') is a recommendation by industry bodies to government, for investment in the growth of UK offshore wind and strengthening of the industrial sector. The report sets out an aim to expand the UK's offshore wind supply chain and grow its market share, domestically and internationally. The plan targets £25 billion in gross value added through a focus on key technologies, leveraging the UK's existing strengths in the sector.

The OWIGP emphasises the need for a strategic approach, with a focus on technologies vital to domestic supply and those where the UK can establish a competitive advantage through innovation. The document sets priorities, objectives, and actions for key technologies, future trends, and innovation.

According to the report, progress will be supported by a new delivery body which will own the growth plan, report against and refresh the plan at intervals, align stakeholders, and champion the UK as a leading destination for investment.

The OWIGP acknowledges that the development of a skilled workforce is a critical factor in making the UK a top employment destination within the offshore wind sector. Workforce Foresighting is referenced within the OWIGP as an approach to identify future workforce capability requirements; however, the plan itself is light on workforce planning and skills development needs.

2.2.2 Overview of the Clean Power 2030 Action Plan

The Clean Power 2030 Action Plan was published by the Department for Energy Security and Net Zero ('DESNZ') in December 2024. The Action Plan describes the UK's transition to clean energy by 2030. The plan sets goals including that:

- Clean energy should comprise 95% of Great Britain's overall generating capacity (currently 60%);
- Clean energy should produce as much power as Great Britain consumes (currently 56%); and
- Great Britain's CO_2 emissions intensity should be below 50g per KWh by 2030 (currently 171g CO_2 / KWh).

The plan reiterates the UK's target of 50GW of offshore wind generating capacity by 2030, although in certain scenarios this target is reduced to 43GW of offshore wind, with a renewed focus on onshore wind and the introduction of low-carbon dispatchable power, such as biomass with carbon capture and storage. Batteries (both domestic, and as large-scale grid-attached storage) also play a significant role, with an increase from 4.5GW current installed capacity up to 23-27GW by 2030.

Skills are a significant consideration in the Clean Power 2030 Action Plan – the only addendum to the report focusses on this issue ("Assessment of the Clean Energy Skills Challenge"). The Skills Challenge Assessment notes that the offshore wind sector has reported persistent skills gaps in high-level electrical, digital, and consenting skills; for roles like Senior Authorised Persons, data analysts and scientists, and regulators. It also notes that there are workforce shortages in the areas of project management, on- and off-shore logistics, and construction resources for floating wind projects. According to the plan, Government will be exploring targeted skills interventions to reskill and upskill workers across the economy. Workforce Foresighting is referenced as a component in resolving the skills challenge, citing ORE Catapult's study on Dynamic Cable Systems.

2.2.3 Topic Longlisting Approach

The OWIGP recommends the UK should be a global leader in five areas of offshore wind:

- Advanced Turbine Technology
- Industrialised Foundations & Substructures
- Future Electrical Systems & Cables
- Smart Environmental Services, and
- Next Generation Installation, Operations & Maintenance

For each of these areas, the plan outlines "Respond, Expand, and Disrupt" programs. The "Respond" programs are focused on addressing immediate infrastructure needs and supply constraints, the "Expand" programs aim to build capacity for emerging export markets, and the "Disrupt" programs seek to establish the UK as a leader in offshore wind advancements through innovation and commercialisation. The plan highlights the need for the UK to increase its manufacturing capabilities in key areas like blades, towers, foundations, and cables, and to enhance its skills in areas like installation, and operations & maintenance ('O&M'). In addition to the list of initiatives, the OWIGP identifies some key technology trends which further inform potential areas for skills foresighting. Copies of relevant figures are provided in A2.1 on page 42.

Thirteen potential foresighting topics were identified through this review:

- Novel manufacturing processes and bonding methods for WTG blade leading edge protection.
- 3D printing of WTG blade leading-edge parts.
- Design of composite WTG blades to enable production with advanced techniques.
- Automating composite manufacturing techniques for blades, e.g. VARTM, ATL, soluble mandrels etc.
- Use of alternative materials to reduce steel weight (towers, foundations) in FoW.
- Use of alternative and synthetic materials for anchors and moorings in FoW.
- Use of synthetic ropes for mooring lines in FoW Development of hybrid energy offshore wind farm solutions.
- Incorporation of power-to-x and energy storage systems in offshore wind farms.
- Development of autonomous windfarm environmental and site inspection survey RAS (hardware).
- Survey algorithm & autonomous controls for RAS environmental and site inspection (software).

- Batteries & energy storage for autonomous survey systems.
- ML analysis of Survey Data (for species monitoring, habitat monitoring).
- Generate solutions for next-generation drive train technologies.

2.2.4 Topic Shortlisting

The shortlisting exercise involved gathering input from lead technologists and senior managers at the Offshore Renewable Energy Catapult:

- Dr. Thomas Wildsmith, Head of Commercial
- Deri Galvin, Head of Industrialisation
- Michael Smailes, Principal Development Engineer.
- Andrew Esson, Future Skills Lead
- Danielle Portsmouth, Future Skills Manager
- Paul Hatchett, Future Skills Consultant (facilitator)
- Andrew Stormonth-Darling, Principal Portfolio Manager – Floating Offshore Wind
- Jack Paterson, Team Leader – Floating Offshore Wind
- Alex Neumann, Chief Engineer – HV Electrical
- Tony Quinn, Director – Technology Development

Participants screened the longlist considering the fit with workforce foresighting methodology, ease of scoping the topic, likely skills needs, and maturity of the technology (i.e. achieving 'horizon 2' around 2030-2032). Topics were challenged and adjusted for suitable scope (neither too broad nor too niche). The group also considered potential collaborations with other Catapults and RTOs, favouring those where there might be some beneficial overlap (see A2.3, page 46).

After a check for omissions, including comparison to the European Technology & Innovation Platform on Wind Strategy (ETIPWind, n.d.), the group carried out a prioritisation exercise considering the level of future skills challenge, and ability to convene an effective working group. This resulted in two clusters of foresighting topics:

Cluster 1

- **Structures – automated welding**: The development and application of automated welding solutions [and assembly methods] for foundations, transition structure and tower sections.
- **Advanced production methods in WTG blades**: Design and production of WTG blades to utilise advanced techniques such as 3d printing / ceramic leading edges, automated production methods.
- **HVDC Cable Systems**: Development and production of high voltage direct current (HVDC) cables in the UK, potentially including novel polymers, and associated equipment.

Cluster 2

- **Smoothing power delivery to grid from Offshore Wind**: Power-to-x (e.g. electrolyser), hybrid and large-scale energy storage systems for offshore wind; also possibly considering system including application of grid forming control in WTG invertors.

- **Autonomous survey**: RAS application for autonomous subsea environmental, site and geotechnical survey (pre-construction).
- **Alternative materials for Floating Offshore Wind moorings / structures**: Use of synthetic ropes, alternative and synthetic materials for mooring lines in floating offshore wind /or/ Use of advanced / novel concrete materials and forming for floating offshore wind foundations, structures.

2.3 Topic Selection and Description

Deriving from the first shortlisted topic, this cycle addresses “Automated Welding of Offshore Wind Flotation Structures” and relates to the development and application of automated welding equipment, production methods and their application, and associated processes such as non-destructive testing.

Part of the rationale in selecting this topic first, was to follow on from an earlier workforce foresighting study led by the National Manufacturing Institute of Scotland (NMIS) looking at automated welding applied to shipbuilding (Workforce Foresighting Hub, 2024). The output from that cycle was used to “seed” this cycle, providing an initial starting point and range of inputs to adopt or adapt from shipbuilding to offshore wind.

2.3.1 Drivers for Automating Welding

There is already a constraint on welders in the UK due to an ageing workforce and reducing intake to the profession. Around half of the 2023 workforce is expected to have retired by 2027, according to Axiom Personnel[1]. Against this background, both the offshore wind sector and nuclear sector are driving an increasing demand, and increasing defence activity may also add to demand. One route to ease this constraint is to automate welding. This in turn requires changes to the structural design, and production methods, to enable automation of welding and automated inspection of the resulting weld.

Automation also offers process benefits such as reducing the operational unit expense (depending on how capital expense is allocated), improving consistency and quality, reducing weld defects and the need for rework. Altogether, advanced production approaches including weld automation offer potential savings of around 8% to 11% for steel structures as shown in Figure 4 (BVG Associates, 2024).

The increasing sophistication of robotic and control systems, as well as the improvement of weld technology such as electron beam welding, mean that robotic solutions to this problem are becoming more feasible as time moves on.

[1] See https://axiompersonnel.co.uk/half-of-the-nations-welders-are-due-to-retire-by-2027-are-we-prepared-for-these-shortages/

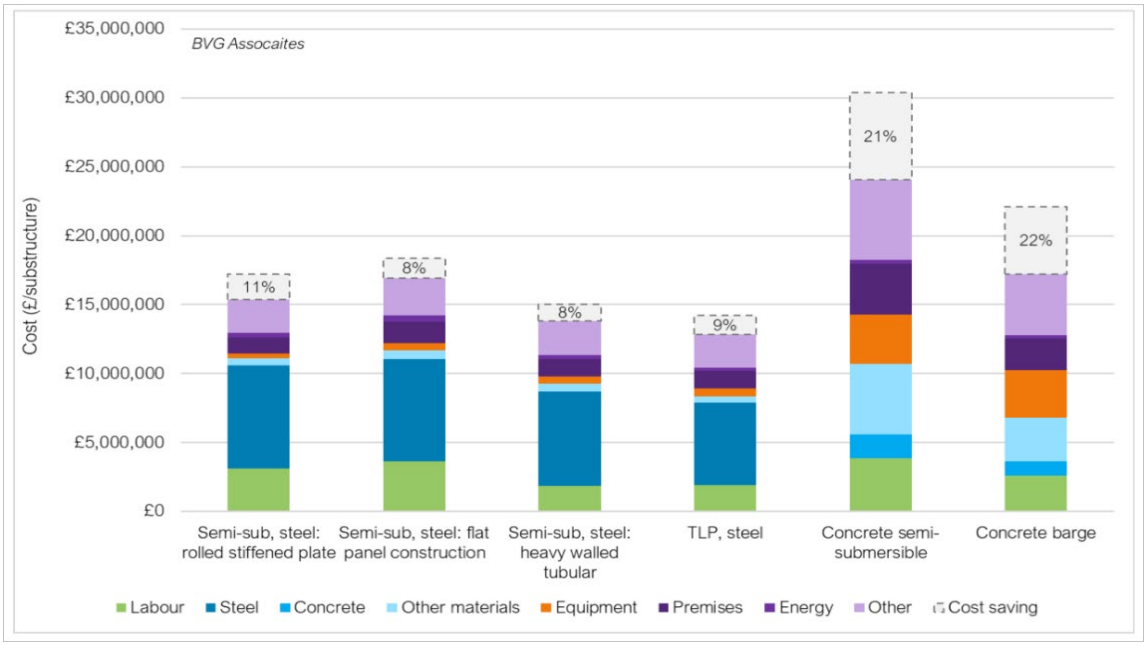

Figure 4 – Cost Reductions in FOW Structures through Advanced Manufacturing (BVG Associates, 2024)

2.3.2 Example Applications: Flotation Structures in Offshore Wind

Types of floating structures used in supporting offshore wind turbines include ballast stabilised, buoyancy stabilised, and mooring (tension) stabilised. These types all have differing designs but spars, semi-submersible / barge types and tension leg platforms (TLP) are the principal design approaches. Different types can be optimal in different water depths, and wave conditions. Spar types have some synergies with tower manufacture, and semi-submersible and TLP types may provide the opportunity for lower mass production costs (Leimeister et al., 2018). An illustration of these different types is shown in Figure 5.

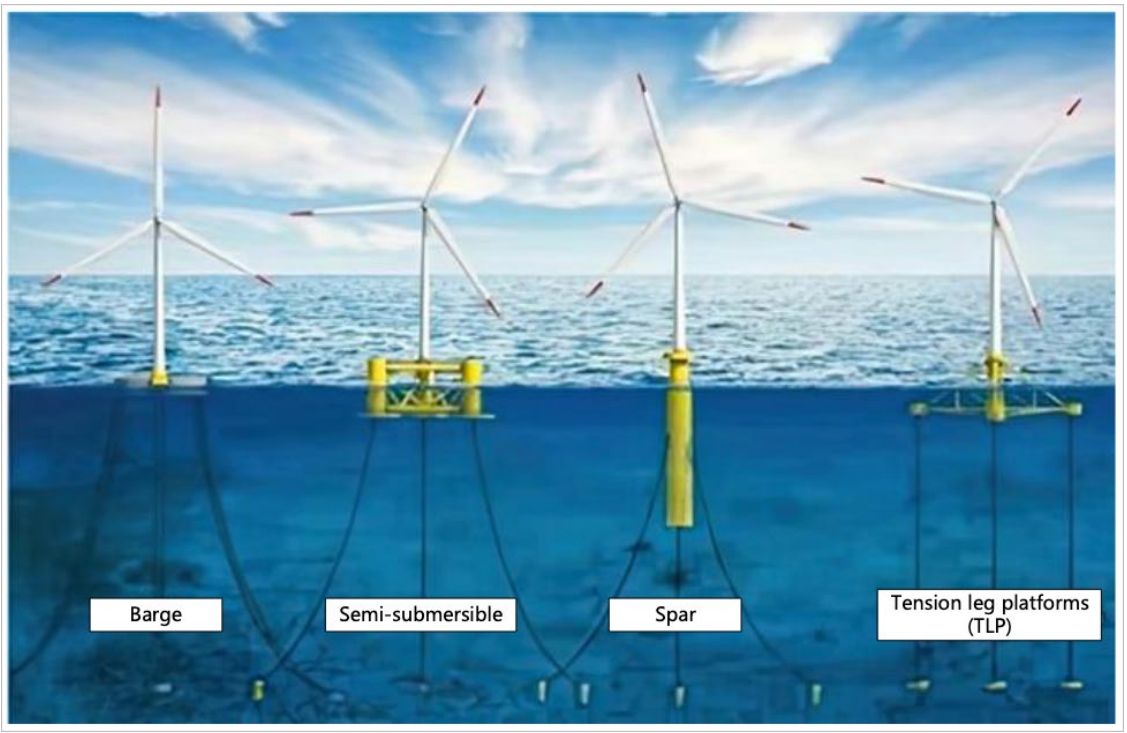

Figure 5 - Four types of offshore floating wind structures (Zhou et al., © 2023 by the authors)

2.3.3 Moving Towards Automated Welding

The ORE Catapult report "PR36: Advanced Manufacturing of Substructure Components" (BVG Associates, 2024) considers some of the implications on welding type and production methodology associated with different types of structure.

Types of welding for advanced production may include the following:

- Electron beam welding – use of high-velocity electrons to fuse materials, suitable for semi-sub (heavy walled, tubular) and TLP structure; and for fixed wind monopiles.
- Submerged arc welding – formation of an electrical arc between a continuously-fed electrode and the workpiece
- Rotary welding – cylindrical sections could be joined using automated welding robots (or 'bugs') on guide bands, more suitable for semi-sub tubular structures.

The types of structures required influence the types of weld that are to be applied, which in turn influences (or de-selects) options for automation, e.g. mobile 'bug' approach vs. gantry- or fixed position robotic arms.

In current methods, structures may be assembled and welding at a single location – such as quayside in proximity to the floating offshore wind project. However, since there is a lower chance of multiple projects being located near the selected location, the investment needed for automation on one project becomes prohibitive.

It is therefore more likely that automation is feasible when there is a larger volume of similar structures (design standardisation) such that setting up a specialist fabrication facility becomes economic; this facility can then deliver substructures to quayside locations for final assembly.

Standardisation of design is a key enabler of automation for these structures. This enables economies of scale to be realised through longer production runs, which in turn offsets the higher capital investment cost of setting up robotic or automated production lines.

2.3.4 Industry Blockers and Enablers in Moving to the Future State

The offshore wind industry supply chain requires visibility and confidence in the project pipeline to commit investment. There is a need for clarity from government to developers and operators, through the supply chain to the fabricators.

Standardisation of design is a key enabler of automation for these structures, as is the case in most products. This enables economies of scale to be realised through longer production runs, which in turn is needed to offset the higher capital investment cost of setting up robotic or automated production lines. There are over one hundred variants in substructure design (BVG Associates, 2024), but these building blocks need to be harmonised and designed in ways that allow for industrialisation.

Technically, BVG suggest that electron-beam welding technology needs to be matured, with innovation to address different component and weld geometries.

The final component is addressed through foresighting: To identify and facilitate growth in the capabilities needed to industrialise through design, implementation, operation and support.

2.3.5 Topic Boundaries

The scope of the foresighting topic was further explored during the verification workshops by mapping key tasks against supply chain and lifecycle (see Table 1) and constrained by considering specific topics that would be outside of scope (see Table 2). Agreeing the scope boundary is a process of discover and requires some flexibility through the workshops; for example, the scope can be a function of which organisations engage and supply participants. The goal is to find a ‘goldilocks’ zone which is neither so broad that it is impossible to cover all the organisational capabilities needed, nor so specialist or niche such that the findings will be of very limited applicability.

SUPPLY CHAIN	DEVISING & DESIGNING	MAKE / MANUFACTURE	INSTALL / COMMISSION	OPERATE / MAINTE
Partner 1 – Fabricators	Identify use case; Design production processes and methods	Reskill workers; manufacture; acceptance testing	Factory acceptance testing; handover	System operation; in-situ maintenance and servicing
Partner 2 - Designers	Interpret design requirements; manage change; design of structures; design of system	Contract and specification management	Engineering approvals	-
Partner 3 – Integrators	Generate solutions; select preferred solutions; assess design requirements	-	-	-
Partner 4 & 5 – Robotic Equipment Suppliers	Design of automation equipment and system	Building robotic and automation equipment; testing	Factory installation; configuration and test	Maintenance and servicing of the automation equipment
Partner 6 – Regulatory Organisations	Guidelines for design; adaptation of standards for automation	-	-	Evaluating and granting regulatory approvals

Table 1 - Key Activities in the Supply Chain

STUDY SCOPE	ACTIVITIES
In-Scope	- Design of structures. - Adaptation/ interpretation of designs for modification; engineering approvals - Design of the automation systems including designing robotics, end-effectors / welding. - Site installation, configuration and test (automation equipment into the factory / line) - Design convergence - Operation of the automation / robotic equipment - Maintenance and support of the equipment - Manufacturing systems and methods. - Quality inspection - Design certification (e.g. DNV)
Out of Scope	- Manufacture / build of the robotic and automation equipment - Activities within the automation equipment manufacturer other than design - Type testing - Wind turbine towers

Table 2 - Study Scope Boundaries

3. Findings and Results

3. Findings and Results

3.1 Capabilities

The technologist and employer workshops in this foresighting study identified an initial set of 124 capabilities[2]. Out of these 124 capabilities, 96 were broadly existing and could be adapted from the IfATE database whilst 28 of the capabilities were created newly for the foresighting topic.

3.1.1 List of newly identified capabilities

The following capabilities have been created (or adapted from others) as part of the study:

ID	Capability Statement
214169	Develop automated welding procedures to ensure precise and consistent bonding of offshore wind flotation structures.
214170	Implement robotic tools to perform high-quality welding on large-scale offshore wind flotation structures.
214171	Optimise production system design to accommodate the specific requirements of automated welding for offshore wind flotation structures.
214172	Coordinate with engineers to integrate robotic welding technology into the production process for offshore wind flotation structures.
214173	Evaluate and select appropriate robotic tools for welding offshore wind flotation structures based on project specifications and requirements.
214174	Build automated production system
214175	Design robotic tools
214176	Automate non-destructive testing (NDT)
214177	Operate automated production line
214178	Design automated production
214179	Implement robotic welding process
214180	Program robotic welding equipment
214181	Monitor and maintain robotic welding systems
214182	Collaborate with engineers to optimise robotic welding parameters
214183	Inspect and calibrate robotic welding tools
214184	Troubleshoot automated welding and assembly systems

[2] An organisational capability is defined in workforce foresighting as a specific activity that enables or improves organisational performance. A capability is likely to be performed by or involve multiple employees and might use specific tools or methods. An example capability statement is “Design policies and procedures for robotic and autonomous systems-based operations in offshore wind.”

ID	Capability Statement
214185	Coordinate material handling for automated welding and assembly
214186	Train team members on operating automated welding and assembly equipment
214187	Analyse data from automated welding and assembly processes for quality control
214188	Integrate robotic welding systems with other production systems
214189	Program welding robots to automatically assemble offshore wind flotation structures using advanced laser scanning technology.
214190	Monitor and adjust welding parameters to ensure quality and structural integrity of offshore wind flotation structures.
214191	Coordinate robotic assembly and welding processes for efficient production of offshore wind flotation structures.
214192	Inspect and test welded joints on offshore wind flotation structures to ensure compliance with industry standards.
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.
214195	Collaborate with design and engineering teams to develop efficient finishing processes for offshore wind flotation structures.
214196	Optimise finishing and coating procedures to minimise environmental impact in offshore wind energy production.
214197	Conduct quality control tests to evaluate the performance of coatings on offshore wind flotation structures.
214198	Utilise automated systems to streamline the finishing and coating workflow for offshore wind flotation structures.
214200	Troubleshoot and resolve technical issues related to automated welding and coating systems for offshore wind flotation structures.
214201	Collate and analyse data from automated welding and coating processes to identify opportunities for improvement.
214202	Implement lean manufacturing principles to optimise the automated welding and coating production line for offshore wind structures.
214203	Train and mentor employees on the use of automated welding and coating technologies for offshore wind flotation structures.
221525	Collaborate and share best practice across projects to enhance project delivery.
221526	Use digital manufacturing systems to gather process performance data
221527	Define and locate the welding environment with safe and suitable access / egress controls
221528	Manage the organisational and workforce transition by identifying processes that will move to automation.
221529	Manage new agreements to ensure responsible risk sharing in the deployment of new technology, supporting subcontractors in leading their automation process changes.
221530	Develop and utilise digital assets for training weld equipment operators

ID	Capability Statement
221531	Ensure data management security whilst ensuring accessibility to coordinate data packages effectively.
221533	Establish coordinated movement to the joint for optimal welding accuracy.
221532	Ensure data compatibility between different suppliers to facilitate seamless integration of information.
214199	Maintain and calibrate automated welding and coating equipment to ensure consistent performance and quality.

Table 3 – Identified Capabilities

3.2 Sensemaking and FOP Guiding Principles

When developing future occupational profiles, it is very useful to define a set of guiding principles that help to understand what a particular group of occupational profiles are designed to achieve. The guiding principles help participants to make sure that a profile title is descriptive of its intent and then help to determine whether or not particular capability belongs in a particular profile.

The guiding principles for the future occupational profiles within the automated welding study were:

- Design offshore wind structures to enable / support weld automation.
- Develop the automation and welding technology.
- Implement automated welding technology in production / fabrications.

An additional principle around adapting and applying industry compliance to account for welding automation had been expected at the outset (ref. Table 1). However, the study generated only a small number of 'doing' (practitioner or expert proficiency) capabilities aligned to this profile, which is an insufficient number to take forward. Similar logic applied to an expected 'trainer' FOP – whilst the group generally understood that there would be a need for training, the core organisational capabilities around training itself (as opposed to domain knowledge) would not change much compared to today.

3.3 Resulting Future Occupational Profiles

The following table shows the titles of the profiles by role family, against each of the guiding principles defined. The Future Occupational Profiles are fully stated in the report appendix (see Appendix 5 - page 52 onwards).

The role families indicate the general level of qualification or equivalent experience that might be expected for a given profile:

- Role Family 1 (RF1) roles are at an entry grade technician or operator level.
- Role Family 2 (RF2) roles are intended for senior technicians and operators.
- Role Family 3 (RF3) roles are graduate / junior engineer level.
- Role Family 4 (RF4) roles are pitched for senior engineering levels or equivalent.

The FOPs are also designed with consideration to progression between the different role families.

Guiding Principle	RF1 FOPs	RF2 FOPs	RF3 FOPs	RF4 FOPs
Design offshore wind structures to enable / support weld automation	- n/a	- n/a	- Design Engineer, Flotation Structures	- Senior Design Engineer, Flotation Structures / 'DfX' - Digitalisation, Data & Analytics
Develop the automation and welding technology	- n/a	- Weld Technology Technician	- Weld Automation Systems Engineer - Weld Technology Engineer	- n/a
Implement automated welding technology in production / fabrications	- Automated Weld Line Operator	- Automated weld line supervisor - Automated Weld Line Logistics Operator	- Weld Inspector / QA Engineer	- Digitalisation, Data & Analytics

Table 4 - Guiding Principles and Future Occupational Profiles

The capabilities within one FOP could be relevant to another stage of work or part of the supply chain. The following table considers the FOPs by role family and indicates where in the supply chain such a role might sit primarily (P) or additionally (+). Ultimately industry will determine how and where capabilities are deployed but the FOPs and alignments should provide a basis for role design and skills development.

RF	FOP	Design Authority	Fabricator / Manufacturer	Automation Equipment Supplier
1	Automated Weld Line Operator		P	
2	Weld Technology Technician		P	
	Automated Weld Line Supervisor		P	
	Automated Weld Line Logistics Operator		P	
3	Design Engineer, Flotation Structures	P	+	
	Weld Automation Systems Engineer		+	P
	Process Manufacturing Engineer		P	+
	Welding Technology Engineer		+	P
	Weld Inspector / QA Engineer	+	P	+
4	Senior Design Engineer, Flotation Structures	P		
	Digitalisation, Data & Analytics	+	P	+

Table 5 - Applicability of Future Occupational Profiles to Supply Chain Tiers

3.4 Potential Pathways to the Future Occupational Profiles

The following table shows the closest fitting existing standard to each of the FOPs identified and then lists the additional capabilities that the FOP requires over and above those in the existing standard. The fit factor (FF) shows the amount of the existing standard that is assessed by the large language model to be a 'match' (based on a threshold of 51%). The surplus factor (SF) shows the amount of the existing standard which does not appear in the FOP.

These standards may therefore provide 'pathways' for development of the FOP roles. These are by no means the only pathways, and in fact, the absence of an identified pathway tends to indicate that the role has a higher proportion of new or adapted capabilities, which means it is difficult for the AI to match it to an existing standard. The AI cannot distinguish between capabilities that are typically trained or taught, versus those that are learned 'on the job'. Including domain-specific language in the capability naturally reduces the likelihood of fit. Another issue with the matching approach may be that it does not take proficiency levels into consideration.

We anticipate that further review of these profiles with employers, and the education and training community, will help to identify further potential pathways. The list of extra capabilities against the FOPs is given in the appendices (see Appendix 4 - from page 48).

RF	FOP	Foundation standard	FF	SF	New Caps.	Comment
1	Automated Weld Line Operator	Welder	65%	14%	8	The new skills relate to operation of the automation equipment. However, we expect the high FF is due to matching on the word 'weld', whereas in practice the skill set may be quite different, and operating production equipment may not use much of a welder's scarce skill set. Although showing a lower FF and higher SF, practically this role might be closer to the automated weld line operator than a welder.
		Process Industry Manufacturing Technician	41%	58%	15	

RF	FOP	Foundation standard	FF	SF	New Caps.	Comment
2	Production Supervisor	Plate Welder	53%	18%	15	All welding profiles offer roughly similar fit. In practice, the production line supervisor would most likely be a progression from the line operator type of role or recruited for supervisory rather than technical skill set.
2	Logistics Operator	No fit	-	-	-	This may be because the logistics standard does not exist and is under review by IfATE or may reflect an unusual 'bucket' of capabilities c.f. IfATE standards.
2	Weld Technology Technician	Engineering and Manuf. Support Tech.	43%	50%	8	The match seems logical.
3	Welding Automation Engineer	Robotics Engineer	33%	41%	22	Logically a good starting point. The high number of new capabilities required includes 10 capabilities with the phrase 'offshore wind' – in other words, domain specific knowledge that would likely be learned 'on the job'.
3	Process Manufacturing Engineer	-	-	-	-	Although there are no capability matches showing in the visualisation tool, a general manufacturing engineer or process engineer would be a solid foundation for this profile.
3	Weld Inspector / QA Engineer	Nuclear Welding Inspection Tech.	83%	20%	3	A strong match here; most quality engineer roles and pathways should form a suitable basis for the FOP.
3	Design Engineer, Flotation Structures	Naval Architect	29%	50%	12	Though these engineering disciplines appear towards the top of the match list, any mechanics-oriented engineering discipline is a good starting point.
		Aerospace Engineer	29%	76%	15	
3	Weld Automation Systems Engineer	Robotics Engineer	66%	29%	10	Again the robotics engineering role is a good fit here. Mechatronics / Electro-mechanics engineer, and control systems engineer also have some fit (25%) but higher SF scores.
3	Welding Technology Engineer	Robotics Engineer	36%	47%	15	Reflects the automation and robotics elements of the profiles. Mechatronics Engineering should be another good foundation.
4	Senior Design Engineer	Robotics Engineer	40%	35%	12	As above
4	Digitalisation, Data and Analytics	Digital Manufacturing Engineering Leader	55%	0% (?)	7	A good fit: this may be a newer standard that reflects contemporary capabilities in this discipline.

Table 6 - Comparison of Future Occupational Profiles with Existing Standards

4. Conclusion and Next Steps

4. Conclusions and Next Steps

4.1 Interim Process Evaluation

Workforce Foresighting – as a process – continues to seek a balance between adjustment for improvement and providing stability across multiple cycles. This carrying-out phase included several adjustments to process and workshops compared to previous cycles. As the process continues to evolve, some points for consideration identified during this cycle include:

- Focussing participants' attention on 'differential' capabilities (future state versus today), is useful in streamlining the capability identification stage.
    - However, the process for 'map and gap' comparisons needs review considering the focus on differential capabilities.

- Replacement of PowerBI with a broader Retool interface is a step forward – but the use cases for the various visualisation tool components needs checking against other evolutions in process, and for usability to industry participants.

- There is a need to be able to easily view all capabilities versus all occupational profiles as part of the sensemaking activity and QA4 / Workshop 2B. At present the Retool interface only supports reviewing one FOP at a time, which risks losing context between FOPs.

- Continued high quality of facilitation from the Workforce Foresighting Hub team.

- Combining the initial onboarding brief with workshop 1A worked well to compress the programme, reduce the time demand on industrial participants, and move more quickly into 'doing' (especially bearing in mind that general overviews are given to participants during the outreach and onboarding stage).

- Replacement of AI generation of the occupational profiles with a workshop approach is a significant improvement. Use of the 'guiding principals' here also helps with clarity and understanding.

- Understanding the 'baseline' or foundational skill sets and qualifications associated with the proposed future occupational profiles, may be a useful way to understand the practical application and education pathways that lead to the future state.

4.2 "Carrying Out" Phase Recommendations

Broadly, the existence of the energy skills assessment within the Clean Power Action Plan 2030 (Department for Energy Security and Net Zero, 2024) – and its reference to foresighting – is encouraging. Planned and current national developments including the Skills England set up, regional skills initiatives, the industry Skills Passport project, and the forthcoming Office for Clean Energy Jobs, all point towards a growing focus on getting the right talent in place – and the awareness that timing grows tight.

The principal recommendation is to continue this foresighting study into the 'causing action' phase. Validating the FOPs with industry via this report is the first step in that journey. At this stage there is no prioritisation between FOPs, and the foresighting process implies that all capabilities are required within the industry by 2030, with equal focus, to support successful deployment of RAS and growth of offshore wind. Nevertheless, it is sensible to consider foresighting alongside forecasting and current course provision, to build a comprehensive picture in the early part of the next phase.

4.3 Next Steps – "Causing Action"

The Clean Power Action Plan 2030 notes that "Most of the workforce we need for 2030 is already employed, so retraining, upskilling and increasing the transferability of workers between sectors is essential." In terms of foresighting this is an interesting assertion, as it *suggests the focus should be on professional training delivery rather than apprenticeship and degree provision*. At the same time, the energy skills assessment also considers the "pressing need to train the younger generation to ensure long-term talent supply" in STEM skills. It cites findings by WorldSkills UK that 63% of 16–24-year-olds have never heard of 'green skills', and that only 27% of those who have heard of 'green jobs' could explain what the term means. ORE Catapult should bear these findings in mind when considering where to focus attention in the 'causing action phase.

In the next phase of the foresighting cycle ORE Catapult will work with stakeholders to identify and initiate actions to close the potential future skills gaps identified through foresighting, considering the volume of likely roles determined by forecasting.

Moving into the "Causing Action" phase of the foresighting cycle, ORE Catapult will:

1. Incorporate feedback from industrial participants and other reviewers of the future occupational profiles and capability sets.

2. Support ORE Catapult and The Welding Institute in the EPSRC funding application "Advanced Automated Welding for Wind Energy", providing input on skills development and role impacts *(completed)*.

3. Develop forecasts that help to understand component volumes and the expected role numbers.

4. Work with further and higher education partners, as well as industry training organisations, to identify potential course module content – based on foresighting and forecasting.

5. Identify a champion for development of automated welding skills for the offshore wind sector.

6. Evaluate the opportunity for further foresighting studies in floating offshore wind structures.

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5. Appendix

5. Appendices

Appendix 1 - The Workforce Foresighting Process

A1.1 The purpose of workforce foresighting

Our Vision: To foster the organisational capabilities and workforce skills required to adapt to continuing change and enable adoption of innovative technologies to enable a prosperous UK industry.

Our Mission: To provide the process, insight and recommendations required to identify and address future skills demands to enable the UK to adopt innovation and succeed in the dynamic global marketplace.

Our Goals:

Define future capabilities required across a sector in response to a challenge, or technology innovation and consequently define the skill sets of the workforce of the future.

Understand and explain gaps between technology adoption, organisational capability and workforce profiles that could hamper innovation.

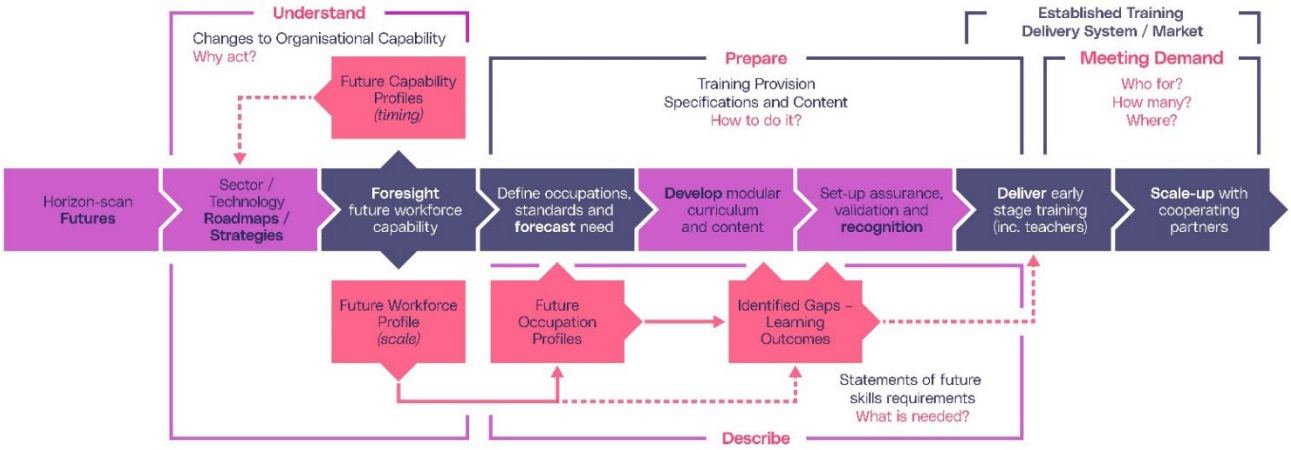
Identify and communicate insights, future requirements and the action required by industry and educators.

Enable and deliver a consistent approach to workforce Foresighting.

A1.2 Outcomes

The process integrates insight from experts in three categories – domain specialists/technologists, employers, and educators. Using a structured and facilitated series of collaborative information-gathering workshops, combined with data from open-source global data sets, the workforce Foresighting process can produce a wealth of detailed quantitative data to inform action.

At the heart of the Foresighting process are working groups consisting of the industry sponsor and centre of innovation, with support from the Workforce Foresighting Hub team, who undertake detailed analysis to report and summarise key data insights and recommendations for action. This report details future supply chain capabilities, prototype future occupational profiles and identifies changes required to current training provision for the sponsor to take forward and address skills challenges relating to the specific topic.



Workforce foresighting is a data intensive approach that can provide sponsors, stakeholders and participants with detailed insight about future workforce requirements. A dynamic data set is provided for each cycle to allow all stakeholders and participants to freely access and interrogate the data. Additionally, the WFH team will support the production of a report that provides targeted recommendations that require action to address gaps in training and education provision relevant to the challenge and planned technology solution.

The dynamic data portal provides a range of standard data sets and visualisations. Additionally, users can download data to undertake their own more detailed interrogation of data to guide and inform subsequent actions.

The key aspect is to provide insight about gaps – which capabilities required in the future are NOT addressed by aspects of current provision – apprenticeship standards, qualifications or other provision. Gaps represent:

- **Short term CPD** – topics required across the workforce to upskill members of current workforce
- **Medium term** – topics to be included as current provision / standards are reviewed and updated
- **Longer term** – new qualifications and standards that may be needed to equip new entrants

The insight produced by a workforce foresighting cycle (project) provides:

- **Technologists** and technical leads with insight of the organisational capability sets required across future supply chain partners in response to the identified challenge.
- **Employers** with insight about possible future roles and occupations that may be required across the whole workforce, operators to researchers, to ensure they are equipped and ready.
- **Educators** with details of the gaps to be addressed by short-course training to upskill the existing workforce and insight about qualifications and provision that will be required to support new entrants in the future.

A1.3 Approach used - principles and implementation

The core of workforce Foresighting is convening three groups of relevant specialists to conduct structured, Delphi-style, facilitated workshops to capture and discuss the set of organisational capabilities that will be required to respond to and exploit technology innovation.

Organisational capabilities are captured using a bespoke classification that has been developed by the Workforce Foresighting Hub. The classification uses a structured common language to enable cross sector and cross centre collaboration and integration of data. Additionally, the classification enables data from several other national and international open-source workforce datasets to be integrated through the same common language. This data is held in a cloud based "data-cube" that is dynamically growing as each workforce Foresighting cycle adds to the shared data relating to future workforce capabilities.

Using innovative AI and Large Language Model data tools, the data-cube is used to undertake detailed analysis to 'map' future workforce capability requirements against the current education and training provision to identify where existing provision can be used and where new provision, CPD or qualifications are required.

As an agile development project, the Workforce Foresighting Hub team are constantly evolving and improving the detailed workshop process and workshop approach, but always consists of the following stages:

Considering – Clarifying the Challenge to be met (the 'what' and the 'when') and collating solutions (the 'how') as Foresighting topic suggestions align with strategic priorities

Identifying – Gain clarity and consensus about the solutions to be put forward – make the case for Foresighting

Preparing – The convening of specialists and scheduling of workshops

Carrying out – Run Foresighting workshops with experts, collate and analyse data

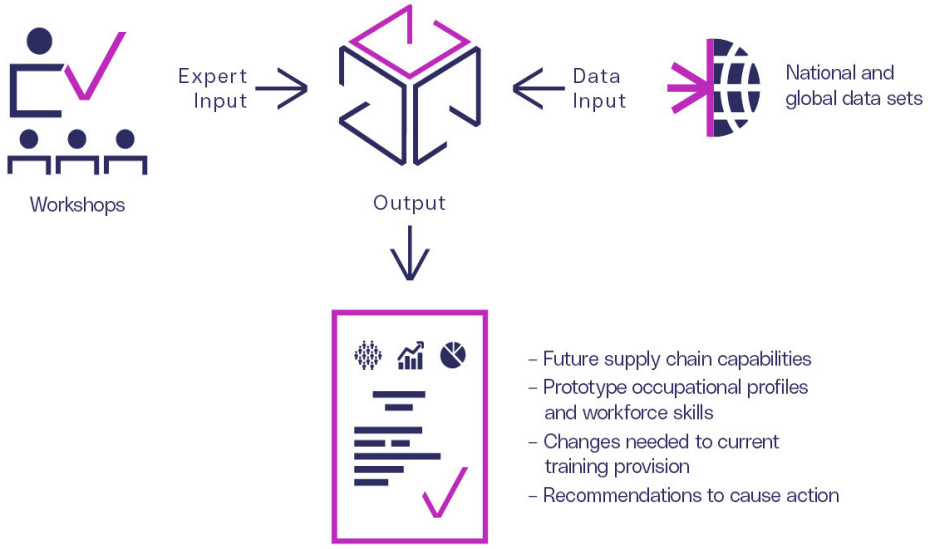
Communicating – Insights, findings and recommendations gathered from all research in report

Causing action – The driving of action based on the recommendations (promoting progress down the rest of the skills value chain) built on the findings and recommendations of Foresighting

During the 'carrying out' phase, capabilities are defined and articulated using a classification system developed by the Workforce Foresighting Hub. This classification builds upon Existing published and widely used national and international frameworks including the Occupational Information Network (ONet) US[3]; European Skills, Competences, Qualifications and Occupations (ESCO)[4]; National Occupational Standards, UK[5]; and the Institute for Apprenticeships and

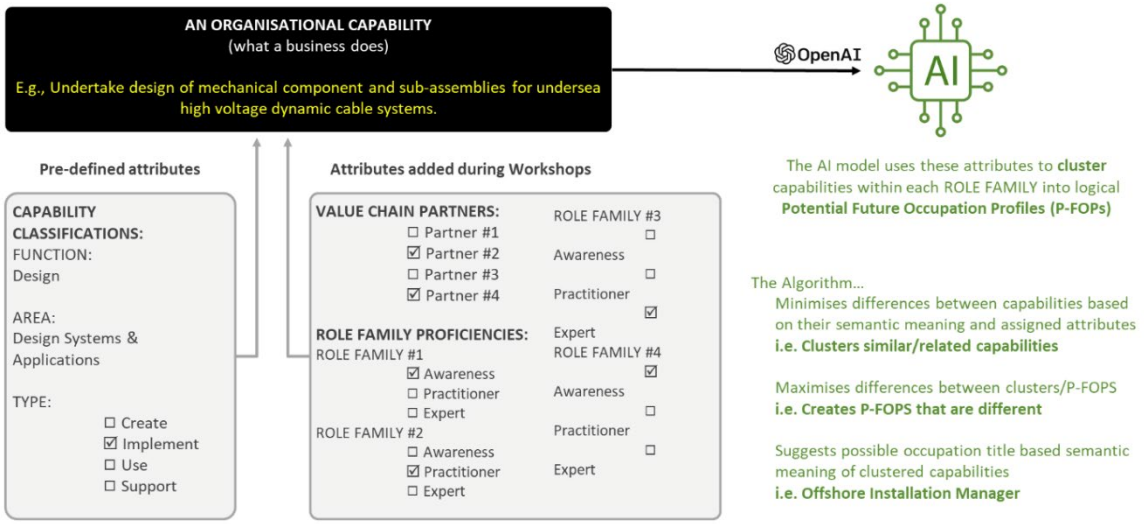
[3] https://www.onetcenter.org/
[4] https://esco.ec.europa.eu/en
[5] https://www.gov.uk/government/publications/national-occupational-standards

Technical Education (IfATE)[6], England. This classification has been used to build a data repository, referred to as the 'data cube' – see figure below – which underpins the workshops and related activities of the carry out phase. Data is input using a common language, which means that any centre conducting similar activities can describe capabilities in a consistent format and vocabulary. The data cube integrates information from ONet, ESCO, NOS, IfATE and other open-source databases, again, using the same common language. The result being a database that is exponentially growing with rich data relating to future workforce capabilities.



OpenAI / ChatGPT large language models are used to analyse workshop input in terms of capability statements, compare these to Existing capabilities in the data-cube, and generate clusters of similar capabilities as potential future occupation profiles.

[6] https://www.instituteforapprenticeships.org/



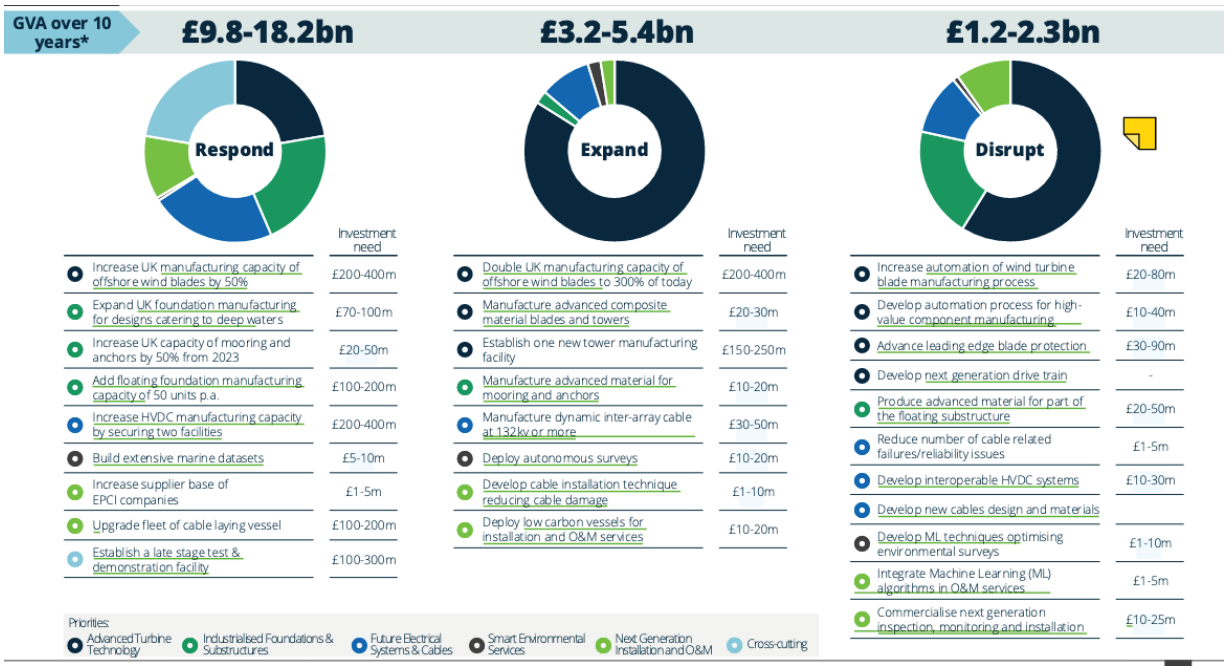
In the final workshop sessions and output, the data-cube is used to ‘map’ the future workforce capability requirements (FOPs) against the current education and training provision, providing a ‘map and gap’ analysis.

Appendix 2 - Consider-Identify-Prepare Work

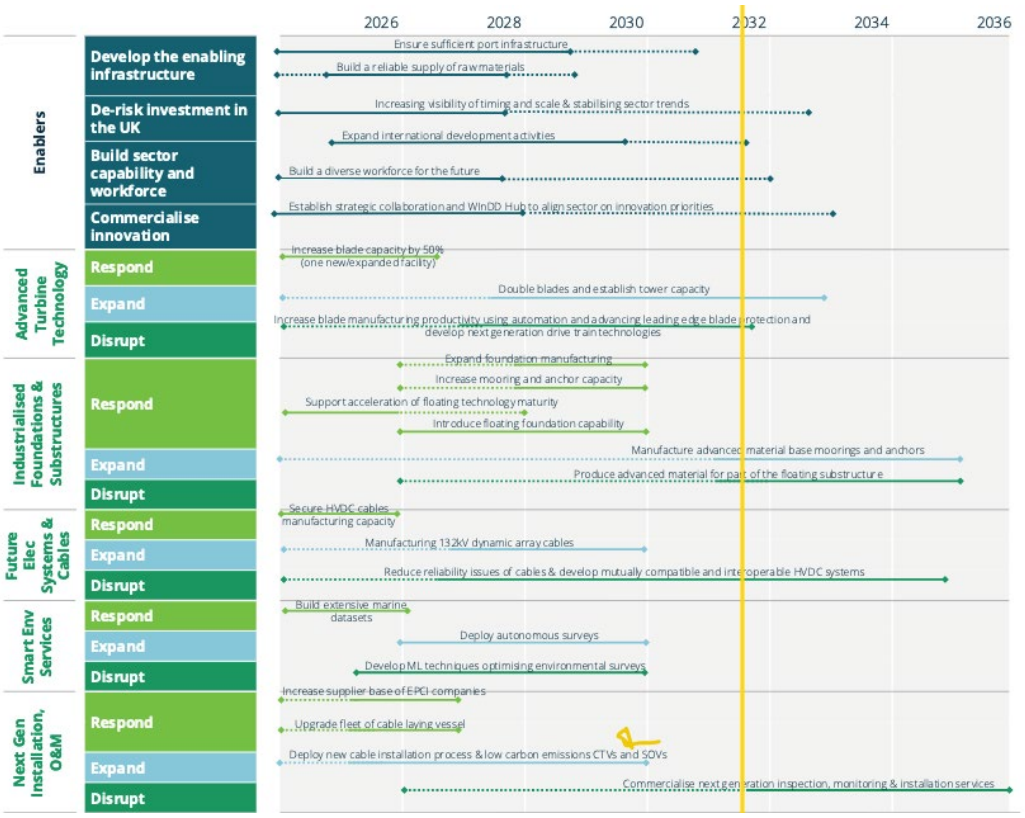
A2.1 Relevant Illustrations from the Offshore Wind Industrial Growth Plan

A2.1.1 'Respond, Expand, Disrupt' Initiatives

Initiatives with green underline were gathered into the long-list for potential foresighting topics:

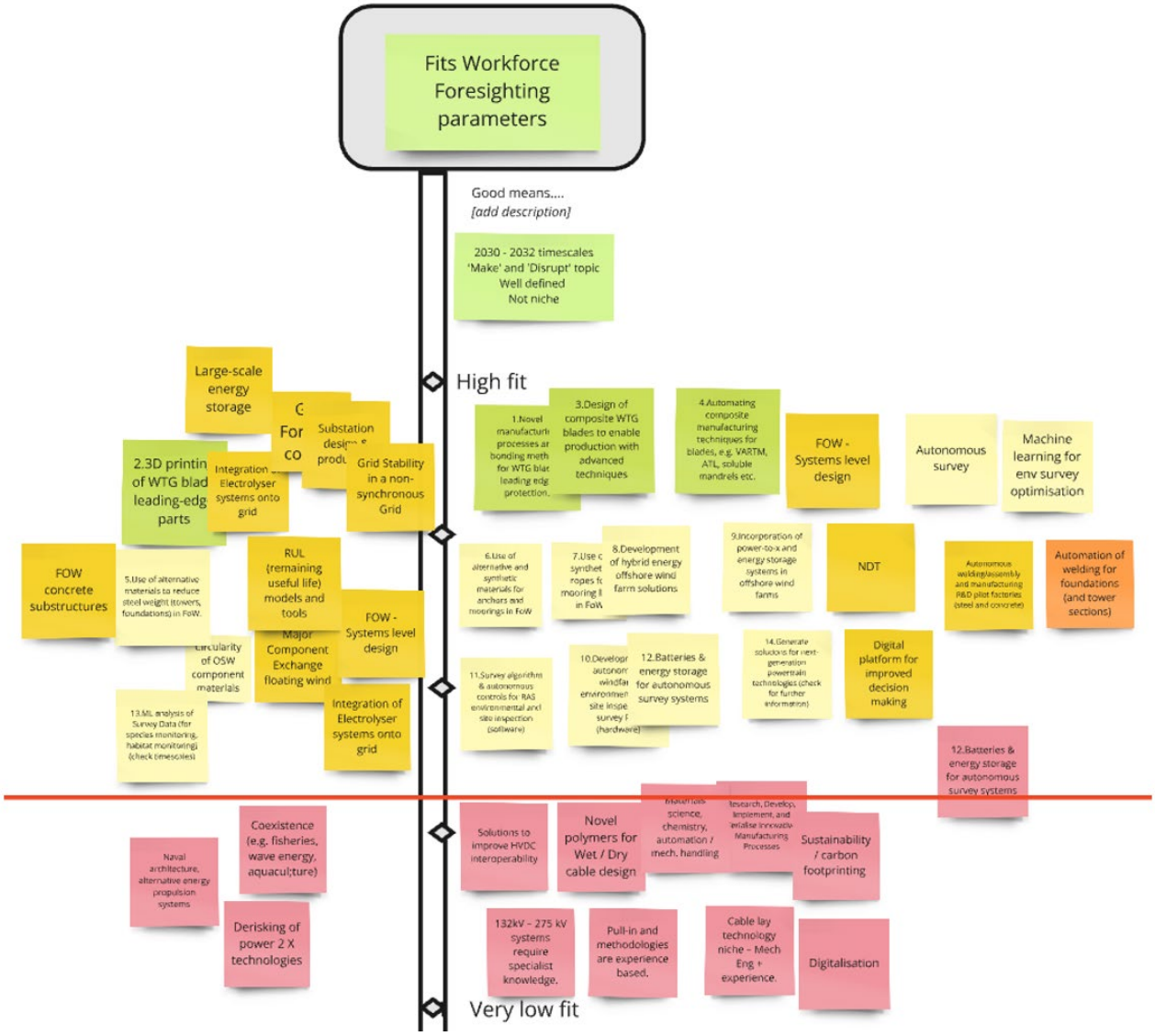


A2.1.2 Timeline with 2032 cut-off

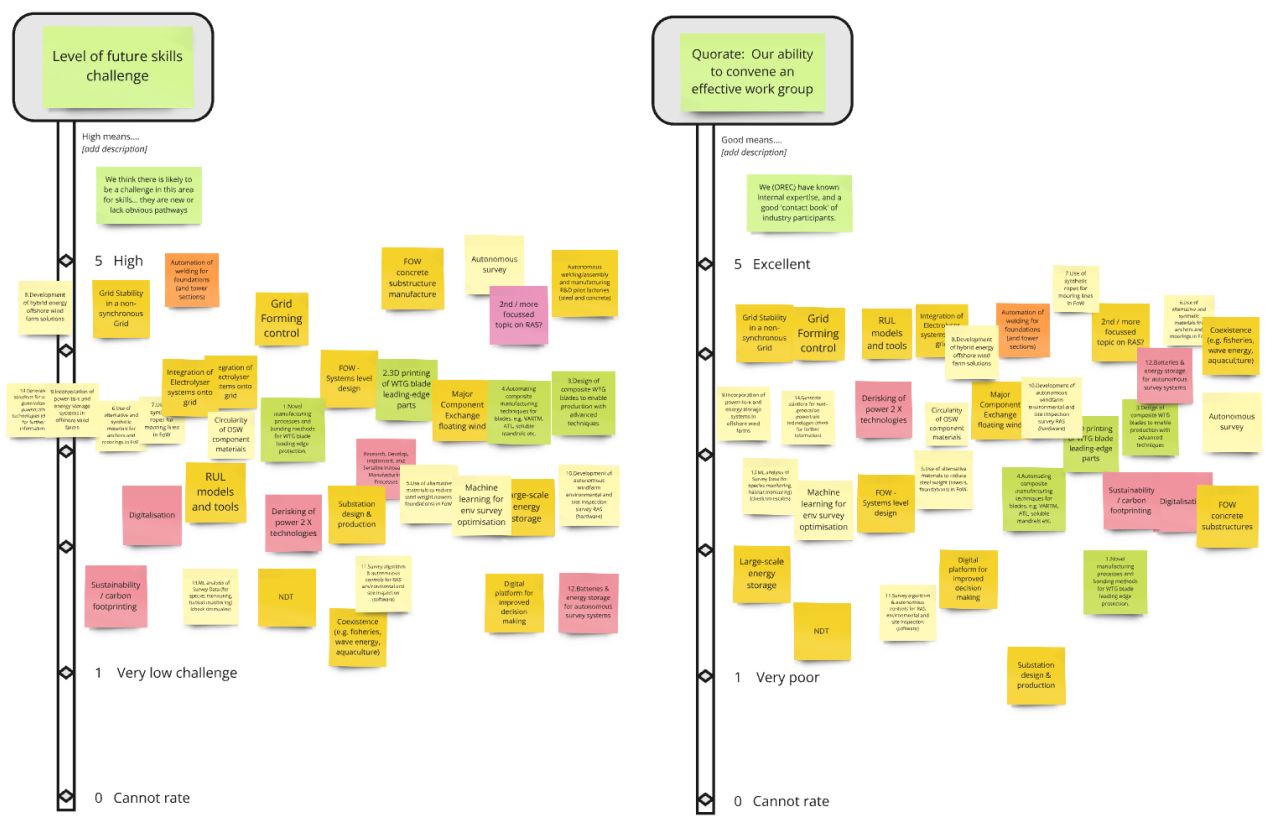


A2.2 Screening and Prioritisation of Potential Foresighting Topics

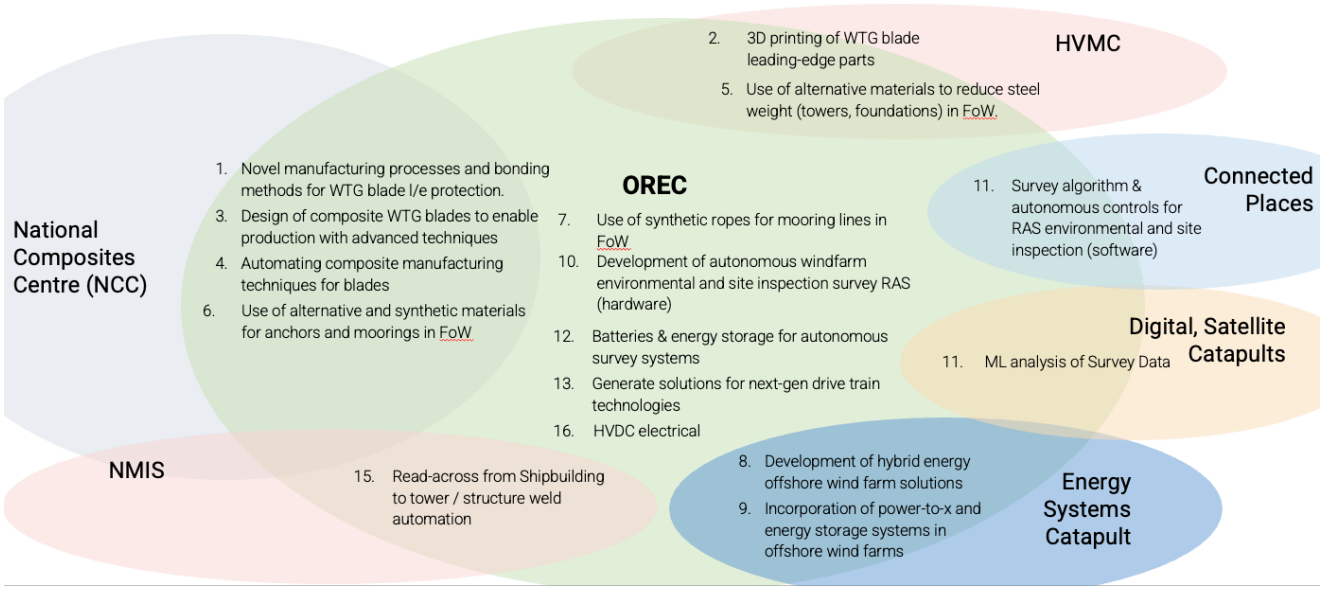
A2.2.1 Fit for Workforce Foresighting Parameters



A2.2.2 Prioritisation – Skills Challenge vs Ability to Convene



A2.3 Potential Cross-Catapult Foresighting Topics



Appendix 3 - Online Data visualisation Tool

The interested reader may wish to access the online data visualisation tool which provides several different ways to view the cycle data. This content and the guidance below is provided and maintained by the Workforce Foresighting Hub.

Access URL: Data Capture Overview | HVMC Foresighting

Visualisation Tool Section	What is it and what can it be used for?
Data Capture Overview	Provides a summary of the data captured across the foresight cycle, bringing together the work of the Technologists / Domain Specialists, Employers and Educators into one overview.
Value Chain Capabilities	Provides an overview of the identified capabilities at a Supply Chain / Workflow Partner level. By selecting/deselecting each Supply Chain / Workflow Partner you can review the capabilities identified as required in that area of the Supply Chain / Workflow. This can be used to generate organisational capability profiles for each area of the workflow /supply chain to help prioritise and focus the acquisition of new capabilities that will be required in the future. It can also be used to generate combined organisational profiles, where an organisation may be involved in more than one area of the supply chain.
FOP Detail	This page allows you to review a specific Occupational Profile, including the capabilities contained within it and the Knowledge, Skills & Behaviour (KSB) tags associated with the capability. You can select an individual Role Family and linked FOP in the two available drop-downs. The table in the lower section of the page will then be populated with all relevant capabilities. The search control above the table allows you to filter content of any of the columns of data. A key piece of functionality in this table is the presence of the KSB tags associated with the capabilities.

Visualisation Tool Section	What is it and what can it be used for?
FOP Matrix	Provides a detailed breakdown of future occupational profiles that could be required in the future workforce. These were generated using a combination of attributes collected through the workshops and an algorithm. These suggested profiles were then reviewed and ratified by small groups of employers who were able to add/remove capabilities and uprate/downrate proficiency levels required. You can view all the FOPs in a role family by selecting one (or more) of these from the drop down. This will then allow you to select the FOPs aligned to that role family. The populated table allows you review and compare different FOPs within or across role families. You can view the capabilities in each FOP and the assigned proficiency levels. You can also toggle 'Hide Empty Capabilities' on/off to reduce the view down to only those capabilities included in the role family you are reviewing.
Future KSBs Summary	Provides a view of the complete set of capabilities within the cycle along with all of the associated KSB tags which are linked to them. It is, essentially, the superset of all details displayed on the FOP detail page. This is used to: • To review the identified Knowledge, Skill and Behaviour tags for a given capability, to support development of future education and learning material. • To review the requirements from a capability level, rather than a role family/occupational profile grouping.
FOP Distribution	This page allows provides a breakdown of the Capabilities within the selected Cycle and how they are distributed across the FOPs with the addition of a distribution chart showing the required proficiency across those FOPs. Clicking the "View FOPs" button alongside each capability will provide a list of the proficiencies (EPA) with the FOPs that fall into them. The exported version of this data will include a full breakdown of the FOP IDs which contain the capability within a specific proficiency. This is used to: • understand the levels/volumes of common/crossover Capabilities, to support prioritisation of Capability Development • identify which Occupational Profiles contain these common/crossover capabilities, and so which may be prioritised for development activity

Visualisation Tool Section	What is it and what can it be used for?
Capabilities Matched to Current Provision	This page allows you to review and compare individual capabilities against 'Duty' statements in an Apprenticeship / Occupational Standard. You can select individual capabilities to review their specific matches. These matches are shown in the bottom panel, including the Standard, the Level and the Duty Statement this is matched to. You can filter in several ways to focus your review: • By the Capability Classification Framework (left-hand panel). • By capabilities that **are** served by the reference mapping framework – the default is Institute for Apprenticeships and Technical Education (IfATE) provision. • By capabilities that **are not** served by the reference mapping framework, e.g., IfATE provision – these are capabilities required in the future that may require new/bespoke training and CPD materials to be developed to upskill/re-skill the workforce. This page can be used to identify where existing provision may exist across the broad spectrum of Occupational Standards, and not just within a narrow range of sector-specific Standards. The data also allows you to identify where provision may already exist to support specific capabilities.
Fit & Surplus Factors	This page allows you to review the 'Fit' and 'Surplus' of Prototype Future Occupation Profiles (FOP) against existing training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). It is possible for the 'Fit' and 'Surplus' comparison to total over 100%, as they are two separate calculations based on a two-way comparison.
Fit & Surplus Matrix	This page is a visual representation of the 'Fit and Surplus Factor' insight. You can visually review 'Fit' and 'Surplus' of Future Occupation Profiles (FOP) against existing training provision e.g. Institute for Apprenticeships and Technical Education (IfATE). This can help you identify which provision may align strongest, or which may require adaptation, to provide the suitable provision fit for each future role. It will help you focus in on which provision to focus your attention for analysis.

Visualisation Tool Section	What is it and what can it be used for?
FOP Capability Matches	This page allows you to view the matches between Capabilities and Institute for Apprenticeships and Technical Education (IfATE) Duty Statements. Clicking the arrow next to a number in the 'Matches' column will open a popup with more detail for each Capability. Each capability also includes Knowledge, Skill and Behaviour Tags, to support with scaffolding future education provision. You can review individual Future Occupational Profiles (FOPS) or review all FOPs under a Role Family, to give a more holistic view of Capabilities and Matches Where a future capability has been matched to existing provision (currently, by default, IfATE apprenticeship standards) it is possible to interrogate the data and identify specific statements in standards that align to enable identification of existing training materials and activities that could be used or adapted to meet future requirements. This can be used to review the capability requirements for Role Families and FOPs, from Job / Occupation level through to Knowledge, Skill and Behaviour level
FOP vs Provision	This page allows you to compare FOPs against existing IfATE Standards. The information here allows you to prioritise effort or action over the short, medium or long-term. This is displayed as a Matched/Not Matched Capability, comparing the Capability in a FOP to the Duties in a Standard. The left-hand side allows you to select the Role Family and FOP, while the right-hand modal allows you to compare against the top 10 matched IfATE Standards for that Occupational Profile. Where a future capability has been matched to existing provision (currently, by default, IfATE apprenticeship standards) it is possible to interrogate the data and identify specific statements in standards that align to enable identification of existing training materials and activities that could be used or adapted to meet future requirements.
FOP Priorities	Provides a list of all the FOPs within the selected cycle with details of their fit and surplus factors. The information here allows you to prioritise effort or action over the short, medium or long-term.

Appendix 4 - New Capabilities Compared to Existing Standards

A4.1 Engineer / Senior Engineer Levels

Welding Automation Engineer c.f. Robotics Engineer

FF 33.3%
SF 41.2%

ID	Capability Statement
221517	Develop automated welding procedures that comply with codes and standards for offshore wind flotation, transition and tower structures.
214170	Implement robotic tools to perform high-quality welding on large-scale offshore wind flotation structures.
221510	Adapt and implement changes and best practices from other relevant industries to meet the demands in floating offshore wind structures
221505	Adapt to changing demands and new materials and methods in offshore wind structures
225814	Adapt structural designs to make offshore wind structures suitable for automated welding
221521	Create templates for welding of fixtures sub-component and child parts
214191	Coordinate robotic assembly and welding processes for efficient production of offshore wind flotation structures.
214174	Build automated production system
214200	Troubleshoot and resolve technical issues related to automated welding and coating systems for offshore wind flotation structures.
197012	Implement digital twin technology to monitor, operate and optimise production processes.
202235	*Collaborate with designers to understand their vision and translate it into automation requirements
210366	Inspect initial weld run for penetration profile and visual defects.
214183	Inspect and calibrate robotic welding tools
181883	Ensure Welding is integrated in the end-to-end process for the product lifecycle for example product verification, design proving, material applications and methods related to conformance to customer specification
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.
214176	Automate non-destructive testing (NDT)
182749	Supervise/manage/oversee activities such as installation of automation & control equipment and industrial networks
182475	Design and install new process lines to meet emerging business needs.
214198	Utilise automated systems to streamline the finishing and coating workflow for offshore wind flotation structures.
214203	Train and mentor employees on the use of automated welding and coating technologies for offshore wind flotation structures.
214171	Optimise production system design to accommodate the specific requirements of automated welding for offshore wind flotation structures.
214202	Implement lean manufacturing principles to optimise the automated welding and coating production line for offshore wind structures

Weld Inspection Engineer c.f. Nuclear Welding Inspection Technician

FF 83%

SF 20%

ID	Capability Statement
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.
221505	Adapt to changing demands and new materials and methods in offshore wind structures
210357	Plan calibration test sequences according to equipment specifications, scientific principles, and production schedule.

Design Engineer – Flotation Structures c.f. Naval Architect

FF 29%

SF 50%

ID	Capability Statement
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.
221510	Adapt and implement changes and best practices from other relevant industries to meet the demands in floating offshore wind structures
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data
182516	Interpret technical specifications & drawings to establish detailed welding process controls, consumable selection, and dimensional limitations imposed to control distortion.
46380	Determine required equipment and welding methods, applying knowledge of metallurgy, geometry, and welding techniques.
181883	Ensure Welding is integrated in the end-to-end process for the product lifecycle for example product verification, design proving, material applications and methods related to conformance to customer specification
225814	Adapt structural designs to make offshore wind structures suitable for automated welding
188080	Identify constraints and capture technical requirements for robotics projects.
221515	Design floating offshore wind structures to meet specified safety, efficiency, and economic standards based on test data and specifications.
64970	Evaluate technical specifications to identify equipment or systems best suited for intended use and possible purchase, based on specifications, user needs, or technical requirements.

Design Engineer – Flotation Structures c.f. Aerospace Engineer

FF 29%

SF 76%

ID	Capability Statement
Requires all capabilities listed under 'Naval Architect' comparison, plus:	
221505	Adapt to changing demands and new materials and methods in offshore wind structures
225813	Determine the buoyancy characteristics of floating offshore wind structures to assess stability during deployment.
221503	Incorporate advancements in floating wind structure design to optimise performance and integrate innovative technologies.

Digitalisation, Data and Analytics c.f. Digital Manufacturing Engineering Leader

FF 56%

SF 0

ID	Capability Statement
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data
224441	*Conduct structural analysis and modelling to determine the effects of loads on physical structures using Finite Element Analysis (FEA).
205286	*Implement data quality checks and data validation processes
196784	Design operational networks and apply appropriate security products and processes in line with organisational requirements.
225813	Determine the buoyancy characteristics of floating offshore wind structures to assess stability during deployment.
221532	Ensure data compatibility between different suppliers to facilitate seamless integration of information.
221523	Produce computer simulations to validate process flow.
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data
224441	*Conduct structural analysis and modelling to determine the effects of loads on physical structures using Finite Element Analysis (FEA).

A4.2 Operator / Senior Technician Levels

Automated Weld Line Operator c.f. Welder

FF 65%

SF 14%

ID	Capability Statement
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.
214191	Coordinate robotic assembly and welding processes for efficient production of offshore wind flotation structures.
93180	Maintain service records of robotic equipment or automated production systems.
100500	Monitor machine operations to detect malfunctions or to determine whether adjustments are needed.
100850	Monitor or calibrate automated systems, industrial control systems, or system components to maximise efficiency of production.
188656	Use machinery, equipment, and vehicles in accordance with organisational requirements, manufacturers' instructions and Health and Safety legislation.
202794	*Establish process parameters, measure their impact on product, and take corrective action
180680	Monitor resources and activities throughout the fabrication of products or components, identifying areas for improving the pr

Automated Weld Line Operator c.f. Process Industry Manufacturing Technician

FF 29%

SF 76%

ID	Capability Statement
Requires all capabilities listed under 'Welder' comparison, plus:	

214183	Inspect and calibrate robotic welding tools
214192	Inspect and test welded joints on offshore wind flotation structures to ensure compliance with industry standards.
210366	Inspect initial weld run for penetration profile and visual defects.
210371	Visually inspect weld profiles using appropriate techniques for quality assurance.
182529	Inspect weld preparations, assembly and apply remedial material conditioning appropriate to the preparation processes applied
210363	Optimise robotic welding system using effective work plan sequencing
182513	Assemble and position plate and structural components to be welded, including attachment of bracings, strong-backs, alignment aids, run-on and run-off tabs and backing materials (e.g. ceramic, metallic etc.).
214235	Inspect welded joints for defects using advanced NDT technology.
158630	Set up, operate, or tend welding machines that join or bond components to fabricate metal products or assemblies.
168500	Tend auxiliary equipment used in welding processes.
210358	Load consumables into welding machines to join components efficiently.

Production Supervisor c.f. Plate Welder

FF 29%

SF 76%

ID	Capability Statement
205626	*Utilise advanced data analytics tools to analyse manufacturing data and identify areas for improvement
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.
205632	*Monitor and optimise the performance of digital manufacturing systems
210363	Optimise robotic welding system using effective work plan sequencing
127110	Prepare reports on non-destructive testing results.
214200	Troubleshoot and resolve technical issues related to automated welding and coating systems for offshore wind flotation structures.
221528	Manage the organisational and workforce transition by identifying processes that will move to automation.
93180	Maintain service records of robotic equipment or automated production systems.
100500	Monitor machine operations to detect malfunctions or to determine whether adjustments are needed.
100850	Monitor or calibrate automated systems, industrial control systems, or system components to maximise efficiency of production.
188656	Use machinery, equipment, and vehicles in accordance with organisational requirements, manufacturers' instructions and Health and Safety legislation.
205626	*Utilise advanced data analytics tools to analyse manufacturing data and identify areas for improvement
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.

Weld Technology Technician c.f. Engineering and Manufacturing Support Technician

FF 43%

SF 50%

ID	Capability Statement
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.
221505	Adapt to changing demands and new materials and methods in offshore wind structures
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.
210369	Install , maintain, and repair electrical systems on advanced manufacturing systems.
202944	*Inspect weld appearance and identify defects through visual inspection after welding, and conduct non-destructive testing.
182513	Assemble and position plate and structural components to be welded, including attachment of bracings, strong-backs, alignment aids, run-on and run-off tabs and backing materials (e.g. ceramic, metallic etc.).
83320	Integrate robotics with peripherals, such as welders, controllers, or other equipment.
221518	Program complex robotic systems, such as vision systems.

Appendix 5 The Future Occupational Profiles

This Appendix presents the capability sets defined through the foresighting process to date. Capabilities are grouped into 'future occupational profiles' (FOPs) within four role families:

- Role Family 1 (RF1) roles are at an entry grade technician or operator level.
- Role Family 2 (RF2) roles are intended for senior technicians and operators.
- Role Family 3 (RF3) roles are graduate / junior engineer level.
- Role Family 4 (RF4) roles are pitched for senior engineering levels or equivalent.

Where a FOP has a progression within the subgroup then the two roles are tabulated together (e.g. engineer / senior engineer, or operator / supervisor).

Each capability is identified as (A) Awareness, (P) Practitioner or (E) Expert level for the FOP. In general, the Awareness level capabilities are presented only where there is a corresponding Practitioner or Expert level identified for a progression role (in other words, capabilities where only the Awareness level is present, are omitted here for brevity).

Initially, the FOPs are presented in full. The subsequent section (A4.3) provides the 'delta', or additional capabilities compared to existing standards. This may be of use to educators and trainers in terms of developing modular or conversion course content.

A5.1 Role Family 1 and 2 – (Senior) Technician / Operator Level

A5.1.1 Automated Weld Line Operator (RF1) and Supervisor (RF2)

ID	Capability Statement – Automated Weld Line Operator (RF1) and Supervisor (RF2)	Function	Functional Domain	Functional Area	Type	RF1 Level	RF 2 Level
17000	Calibrate testing instruments and installed or repaired equipment to prescribed specifications.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Use	A	
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.	DESIGN	Technical Research	Research & Develop Technologies	Create	A	P
93180	Maintain service records of robotic equipment or automated production systems.	IMPLEMENT	System/Equipment Operation & Monitoring	Monitor Operations	Maintain	E	E
100500	Monitor machine operations to detect malfunctions or to determine whether adjustments are needed.	IMPLEMENT	System/Equipment Operation & Monitoring	Monitor Equipment	Use	P	P
100850	Monitor or calibrate automated systems, industrial control systems, or system components to maximise efficiency of production.	IMPLEMENT	System/Equipment Operation & Monitoring	Monitor Operations	Use	A	E
127110	Prepare reports on non-destructive testing results.	DESIGN	Prototype Design & Development	Design Systems & Applications	Implement		P
135050	Provide technical support for robotic systems.	SUPPORT	Customer Support	Handle Customer Problems & Inquiries	Use		E
158630	Set up, operate, or tend welding machines that join or bond components to fabricate metal products or assemblies.	IMPLEMENT	Product Processing	Join Components	Use	A	
162230	Start, monitor, and adjust robotic welding production lines.	IMPLEMENT	Product Processing	Join Components	Use	P	
168500	Tend auxiliary equipment used in welding processes.	IMPLEMENT	Product Processing	Join Components	Use	P	

ID	Capability Statement – Automated Weld Line Operator (RF1) and Supervisor (RF2)	Function	Functional Domain	Functional Area	Type	RF1 Level	RF 2 Level
180680	Monitor resources and activities throughout the fabrication of products or components, identifying areas for improving the production process where possible	IMPLEMENT	System/Equipment Operation & Monitoring	Monitor Equipment	Create	P	
181406	Monitor production efficiency of multiple machines to ensure production requirements are met, making adjustments to maintain constant productivity and quality, replacing machine parts as required and set according to machine manufacturers specifications	IMPLEMENT	System/Equipment Operation & Monitoring	Monitor Equipment	Maintain		E
182513	Assemble and position plate and structural components to be welded, including attachment of bracings, strong-backs, alignment aids, run-on and run-off tabs and backing materials (e.g. ceramic, metallic etc.).	IMPLEMENT	Product Processing	Join Components	Maintain	E	E
182529	Inspect weld preparations, assembly and apply remedial material conditioning appropriate to the preparation processes applied	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Maintain	P	E
182537	Adjust parameters throughout the welding of components, recognising the need to adapt to accommodate ongoing changes in welding position and technique (e.g. Preheat, Interpass Temperature, Heat Input).	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Implement	P	
188656	Use machinery, equipment, and vehicles in accordance with organisational requirements, manufacturers' instructions and Health and Safety legislation.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Maintain	P	E
189225	*Conduct inspections using a specific non-destructive testing (NDT) method, understanding its capabilities and limitations.	IMPLEMENT	Service Delivery	Monitor & Evaluate Individual Capabilities	Maintain	A	A
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.	SUPPORT	Quality Control	Manage Quality Control	Maintain	P	P
202794	*Establish process parameters, measure their impact on product, and take corrective action	SUPPORT	Quality Control	Evaluate Product Characteristics & Quality	Implement	A	E
202944	*Inspect weld appearance and identify defects through visual inspection after welding, and conduct non-destructive testing.	SUPPORT	System/Equipment Maintenance	Inspect Facilities & Equipment	Maintain		A

ID	Capability Statement – Automated Weld Line Operator (RF1) and Supervisor (RF2)	Function	Functional Domain	Functional Area	Type	RF1 Level	RF 2 Level
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.	DESIGN	Product Engineering	Create Engineering Designs	Maintain		P
205115	*Adjust and calibrate machine settings to ensure accurate and efficient production	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Use	P	
205626	*Utilise advanced data analytics tools to analyse manufacturing data and identify areas for improvement	ENTERPRISE	Data Management	Perform Data Analysis	Create		P
210358	Load consumables into welding machines to join components efficiently.	IMPLEMENT	System/Equipment Operation & Monitoring	Load Equipment	Use	E	
210363	Optimise robotic welding system using effective work plan sequencing	IMPLEMENT	Plan Operations	Plan Operations	Implement	P	P
210366	Inspect initial weld run for penetration profile and visual defects.	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Implement	A	P
210371	Visually inspect weld profiles using appropriate techniques for quality assurance.	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Implement	P	P
214183	Inspect and calibrate robotic welding tools	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Create	A	E
214187	Analyse data from automated welding and assembly processes for quality control	SUPPORT	Quality Control	Manage Quality Control	Create		P
214190	Monitor and adjust welding parameters to ensure quality and structural integrity of offshore wind flotation structures.	SUPPORT	Quality Control	Manage Quality Control	Create	P	E
214191	Coordinate robotic assembly and welding processes for efficient production of offshore wind flotation structures.	DESIGN	Product Engineering	Create Engineering Designs	Create	P	E

ID	Capability Statement – Automated Weld Line Operator (RF1) and Supervisor (RF2)	Function	Functional Domain	Functional Area	Type	RF1 Level	RF 2 Level
214192	Inspect and test welded joints on offshore wind flotation structures to ensure compliance with industry standards.	SUPPORT	System/Equipment Maintenance	Inspect Facilities & Equipment	Create	E	A
214199	Maintain and calibrate automated welding and coating equipment to ensure consistent performance and quality.	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Create	E	E
214200	Troubleshoot and resolve technical issues related to automated welding and coating systems for offshore wind flotation structures.	IMPLEMENT	Manage Operations	Resolve Operational Problems	Create		E
214201	Collate and analyse data from automated welding and coating processes to identify opportunities for improvement.	IMPLEMENT	Manage Operations	Analyse Operations Data	Create	P	E
214235	Inspect welded joints for defects using advanced NDT technology.	SUPPORT	System/Equipment Maintenance	Schedule Maintenance	Create	A	P
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create		A
221508	Inspect finished products for defects, troubleshoot issues, and maintain digital quality control records for sign-off.	SUPPORT	Quality Control	Evaluate Product Characteristics & Quality	Implement	P	E
221527	Define and locate the welding environment with safe and suitable access / egress controls	IMPLEMENT	Plan Operations	Plan Operations	Implement		E
221528	Manage the organisational and workforce transition by identifying processes that will move to automation.	DESIGN	Process Design & Implementation	Develop Processes	Implement		P
225812	Design and incorporate safety equipment into the welding equipment design and function	DESIGN	Prototype Design & Development	Design Systems & Applications	Create		P

A5.1.2 Automated Line Logistics Operator

ID	Capability Statement – Automated Line Logistics Operator (RF2)	Function	Functional Domain	Functional Area	Type	RF 2 Level
221513	Develop plans and specifications for fabrication, erection, and outfitting of structures for floating offshore wind.	DESIGN	Prototype Design & Development	Create Detailed Product Specification	Create	A
205386	*Integrate robotic hardware and software components to create functional systems	SUPPORT	Operator Support	Design and configure support systems	Maintain	A
210349	Source materials and components for robotic equipment repair.	LOGISTICS	Inventory Management	Restore Inventories	Maintain	E
225809	Specify and Install safety equipment	DESIGN	System/Equipment Design & Implementation	Install Equipment	Implement	E
221519	Define and coordinate the lead times for equipment, parts, and welding consumables to ensure timely delivery.	LOGISTICS	Supply Chain Management	Coordinate Logistics	Maintain	E
204344	*Adapt manufacturing operations to reduce environmental impact and promote waste reduction and recycling	LOGISTICS	Waste Management	Manage Waste	Implement	P
203033	*Install components of large-scale industrial and commercial systems using industry recognised practices	SUPPORT	Operator Support	Design and configure support systems	Maintain	P
51730	Develop specifications for equipment, tools, facility layouts, or material-handling systems.	DESIGN	Prototype Design & Development	Create Detailed Product Specification	Create	P
214185	Coordinate material handling for automated welding and assembly	LOGISTICS	Supply Chain Management	Coordinate Logistics	Create	P

A5.1.3 Welding Technology Technician

ID	Capability Statement – Welding Technology Technician (RF2)	Function	Functional Domain	Functional Area	Type	RF2 Level
210365	Provide technical guidance for optimal performance of advanced manufacturing systems, meeting service commitments.	SUPPORT	Operator Support	Operate support systems	Create	A
202944	*Inspect weld appearance and identify defects through visual inspection after welding, and conduct non-destructive testing.	SUPPORT	System/Equipment Maintenance	Inspect Facilities & Equipment	Maintain	A
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.	DESIGN	Architecture	Design Facilities & Structures	Create	E
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.	DESIGN	Product Engineering	Create Engineering Designs	Maintain	E
202881	*Lead complex maintenance or technical support activities using industrial control systems and applications	SUPPORT	Operator Support	Operate support systems	Maintain	E
182513	Assemble and position plate and structural components to be welded, including attachment of bracings, strong-backs, alignment aids, run-on and run-off tabs and backing materials (e.g. ceramic, metallic etc.).	IMPLEMENT	Product Processing	Join Components	Maintain	E
214183	Inspect and calibrate robotic welding tools	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Create	E
210369	Install , maintain, and repair electrical systems on advanced manufacturing systems.	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Maintain	E
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	P
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.	SUPPORT	Quality Control	Manage Quality Control	Maintain	P

ID	Capability Statement – Welding Technology Technician (RF2)	Function	Functional Domain	Functional Area	Type	RF2 Level
205392	*Provide technical support and training to end-users of robotic systems	SUPPORT	Operator Support	Operate support systems	Maintain	P
83320	Integrate robotics with peripherals, such as welders, controllers, or other equipment.	SUPPORT	Operator Support	Design and configure support systems	Use	P
221518	Program complex robotic systems, such as vision systems.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P

A5.2 Role Family 3 and 4 – (Senior) Engineer Level

A5.2.1 Welding Automation Engineer

ID	Capability Statement – Welding Automation Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
214202	Implement lean manufacturing principles to optimise the automated welding and coating production line for offshore wind structures.	ENTERPRISE	Leadership & Strategy	Develop Sustainable Practices	Create	A
214203	Train and mentor employees on the use of automated welding and coating technologies for offshore wind flotation structures.	SUPPORT	Operator Support	Train others to use equipment	Create	A
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	A
225814	Adapt structural designs to make offshore wind structures suitable for automated welding	DESIGN	Prototype Design & Development	Design Materials & Devices	Create	A

ID	Capability Statement – Welding Automation Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
moni	*Monitor and optimise the performance of digital manufacturing systems	SUPPORT	Operator Support	Design and configure support systems	Maintain	A
181883	Ensure Welding is integrated in the end-to-end process for the product lifecycle for example product verification, design proving, material applications and methods related to conformance to customer specification	ENTERPRISE	Regulatory Compliance	Coordinate Compliance activities	Implement	E
188079	Plan and lead research activities to determine feasibility and applicability of automation solutions.	IMPLEMENT	Service Delivery	Research & Obtain Information	Create	E
197012	Implement digital twin technology to monitor, operate and optimise production processes.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Implement	E
214200	Troubleshoot and resolve technical issues related to automated welding and coating systems for offshore wind flotation structures.	IMPLEMENT	Manage Operations	Resolve Operational Problems	Create	E
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.	DESIGN	Technical Research	Research & Develop Technologies	Create	P
182475	Design and install new process lines to meet emerging business needs.	SUPPORT	Operator Support	Design and configure support systems	Implement	P
182749	Supervise/manage/oversee activities such as installation of automation & control equipment and industrial networks	IMPLEMENT	Service Delivery	Supervise Services	Maintain	P
188080	Identify constraints and capture technical requirements for robotics projects.	DESIGN	Prototype Design & Development	Validate Requirements	Create	P
202235	*Collaborate with designers to understand their vision and translate it into automation requirements	SUPPORT	Operator Support	Design and configure support systems	Create	P
203322	*Ensuring compliance with international standards, codes of practice, and industry regulations in the design and implementation of automation systems.	SUPPORT	Operator Support	Design and configure support systems	Maintain	P

ID	Capability Statement – Welding Automation Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
205392	*Provide technical support and training to end-users of robotic systems	SUPPORT	Operator Support	Operate support systems	Maintain	P
210366	Inspect initial weld run for penetration profile and visual defects.	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Implement	P
214170	Implement robotic tools to perform high-quality welding on large-scale offshore wind flotation structures.	DESIGN	Technical Research	Research & Develop Technologies	Create	P
214171	Optimise production system design to accommodate the specific requirements of automated welding for offshore wind flotation structures.	SUPPORT	Operator Support	Design and configure support systems	Create	P
214174	Build automated production system	DESIGN	Process Design & Implementation	Develop Processes	Create	P
214176	Automate non-destructive testing (NDT)	DESIGN	System/Equipment Design & Implementation	Test Equipment & Systems	Create	P
214180	Program robotic welding equipment	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Create	P
214183	Inspect and calibrate robotic welding tools	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Create	P
214188	Integrate robotic welding systems with other production systems	SUPPORT	Operator Support	Operate support systems	Create	P
214191	Coordinate robotic assembly and welding processes for efficient production of offshore wind flotation structures.	DESIGN	Product Engineering	Create Engineering Designs	Create	P
214198	Utilise automated systems to streamline the finishing and coating workflow for offshore wind flotation structures.	SUPPORT	Operator Support	Operate support systems	Create	P

ID	Capability Statement – Welding Automation Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
214201	Collate and analyse data from automated welding and coating processes to identify opportunities for improvement.	IMPLEMENT	Manage Operations	Analyse Operations Data	Create	P
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221510	Adapt and implement changes and best practices from other relevant industries to meet the demands in floating offshore wind structures	DESIGN	Technical Research	Research & Develop Technologies	Create	P
221512	Implement robotic and automated welding processes.	DESIGN	System/Equipment Design & Implementation	Configure Equipment	Implement	P
221521	Create templates for welding of fixtures sub-component and child parts	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221528	Manage the organisational and workforce transition by identifying processes that will move to automation.	DESIGN	Process Design & Implementation	Develop Processes	Implement	P

A5.2.2 Process / Manufacturing Engineer

ID	Capability Statement – Process / Manufacturing Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
37080	Coordinate installation of new equipment.	DESIGN	Technical Research	Research & Develop Technologies	Use	A
202881	*Lead complex maintenance or technical support activities using industrial control systems and applications	SUPPORT	Operator Support	Operate support systems	Maintain	A
203033	*Install components of large-scale industrial and commercial systems using industry recognised practices	SUPPORT	Operator Support	Design and configure support systems	Maintain	A
210364	Conduct systems integration upskilling to support line reconfiguration and maintenance.	SUPPORT	Operator Support	Design and configure support systems	Implement	A

ID	Capability Statement – Process / Manufacturing Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	A
221522	Develop mock ups and prototypes to refine and validate manufacturing process.	DESIGN	Prototype Design & Development	Develop Prototypes	Create	A
221524	Install configure and function test mechanised equipment and peripherals.	DESIGN	System/Equipment Design & Implementation	Install Equipment	Implement	A
181952	Define and commission the criteria for design choices and the development of sequential models (e.g. work flow, synthesis route, methods of operation) to advise and inform decision-making for policy and business needs.	ENTERPRISE	Regulatory Compliance	Design Policies and Procedures	Create	E
195717	Implement advanced simulation tools to analyse and improve manufacturing processes.	ENTERPRISE	Data Management	Perform Data Analysis	Create	E
197012	Implement digital twin technology to monitor, operate and optimise production processes.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Implement	E
43420	Design engineering systems for the automation of industrial tasks.	DESIGN	System/Equipment Design & Implementation	Design Equipment	Create	P
50210	Develop or implement operating methods or procedures.	DESIGN	Process Design & Implementation	Develop Processes	Create	P
63830	Evaluate current or proposed manufacturing processes or practices for environmental sustainability, considering factors such as greenhouse gas emissions, air pollution, water pollution, energy use, or waste creation.	ENTERPRISE	Leadership & Strategy	Evaluate Environment Impact	Maintain	P
182475	Design and install new process lines to meet emerging business needs.	SUPPORT	Operator Support	Design and configure support systems	Implement	P
182749	Supervise/manage/oversee activities such as installation of automation & control equipment and industrial networks	IMPLEMENT	Service Delivery	Supervise Services	Maintain	P

ID	Capability Statement – Process / Manufacturing Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
210357	Plan calibration test sequences according to equipment specifications, scientific principles, and production schedule.	IMPLEMENT	Plan Operations	Plan Operations	Implement	P
210365	Provide technical guidance for optimal performance of advanced manufacturing systems, meeting service commitments.	SUPPORT	Operator Support	Operate support systems	Create	P
210369	Install , maintain, and repair electrical systems on advanced manufacturing systems.	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Maintain	P
214171	Optimise production system design to accommodate the specific requirements of automated welding for offshore wind flotation structures.	SUPPORT	Operator Support	Design and configure support systems	Create	P
214174	Build automated production system	DESIGN	Process Design & Implementation	Develop Processes	Create	P
214201	Collate and analyse data from automated welding and coating processes to identify opportunities for improvement.	IMPLEMENT	Manage Operations	Analyse Operations Data	Create	P
221510	Adapt and implement changes and best practices from other relevant industries to meet the demands in floating offshore wind structures	DESIGN	Technical Research	Research & Develop Technologies	Create	P
221513	Develop plans and specifications for fabrication, erection, and outfitting of structures for floating offshore wind.	DESIGN	Prototype Design & Development	Create Detailed Product Specification	Create	P
221520	Develop material processes, flow layout plans to streamline fabrication station operations.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221521	Create templates for welding of fixtures sub-component and child parts	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221523	Produce computer simulations to validate process flow.	DESIGN	Process Design & Implementation	Develop Processes	Create	P
221526	Use digital manufacturing systems to gather process performance data	IMPLEMENT	Manage Operations	Analyse Operations Data	Use	P

ID	Capability Statement – Process / Manufacturing Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF 3 Level
221527	Define and locate the welding environment with safe and suitable access / egress controls	IMPLEMENT	Plan Operations	Plan Operations	Implement	P
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data	ENTERPRISE	Data Management	Perform Data Analysis	Maintain	P
225807	Install maintain, and repair systems on advanced manufacturing systems	DESIGN	System/Equipment Design & Implementation	Install Equipment	Implement	P
225809	Specify and Install safety equipment	DESIGN	System/Equipment Design & Implementation	Install Equipment	Implement	P

A5.2.3 Weld Inspector / Quality Assurance Engineer

ID	Capability Statement –Weld Inspector / Quality Assurance Engineer	Function	Functional Domain	Functional Area	Type	RF 3 Level
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	A
50940	Develop or use new non-destructive testing methods, such as acoustic emission testing, leak testing, and thermal or infrared testing.	DESIGN	Technical Research	Research & Develop Technologies	Create	A
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.	DESIGN	Architecture	Design Facilities & Structures	Create	A
210357	Plan calibration test sequences according to equipment specifications, scientific principles, and production schedule.	IMPLEMENT	Plan Operations	Plan Operations	Implement	A
214190	Monitor and adjust welding parameters to ensure quality and structural integrity of offshore wind flotation structures.	SUPPORT	Quality Control	Manage Quality Control	Create	A
182516	Interpret technical specifications & drawings to establish detailed welding process controls, consumable selection, and dimensional limitations imposed to control distortion.	ENTERPRISE	Product Management	Develop Specifications	Use	E

ID	Capability Statement –Weld Inspector / Quality Assurance Engineer	Function	Functional Domain	Functional Area	Type	RF 3 Level
127110	Prepare reports on non-destructive testing results.	DESIGN	Prototype Design & Development	Design Systems & Applications	Implement	E
182529	Inspect weld preparations, assembly and apply remedial material conditioning appropriate to the preparation processes applied	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Maintain	E
210366	Inspect initial weld run for penetration profile and visual defects.	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Implement	E
210371	Visually inspect weld profiles using appropriate techniques for quality assurance.	SUPPORT	Operator Support	Prepare Informational or Reference Materials	Implement	E
214235	Inspect welded joints for defects using advanced NDT technology.	SUPPORT	System/Equipment Maintenance	Schedule Maintenance	Create	E
221514	Apply relevant British and international standards to inspection and reporting of welding and weld quality for offshore wind structures.	SUPPORT	Health, Safety & Environment	Develop Safety Standards	Implement	E
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.	SUPPORT	Quality Control	Manage Quality Control	Maintain	P
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.	DESIGN	Product Engineering	Create Engineering Designs	Maintain	P
214187	Analyse data from automated welding and assembly processes for quality control	SUPPORT	Quality Control	Manage Quality Control	Create	P
214192	Inspect and test welded joints on offshore wind flotation structures to ensure compliance with industry standards.	SUPPORT	System/Equipment Maintenance	Inspect Facilities & Equipment	Create	P
214201	Collate and analyse data from automated welding and coating processes to identify opportunities for improvement.	IMPLEMENT	Manage Operations	Analyse Operations Data	Create	P

A5.3.4 (Senior) Design Engineer – Offshore Wind Flotation Structures / 'Design for Automation'

ID	Capability Statement – Offshore Wind Flotation Structures Design Engineer (RF3) / Senior Design Engineer, Design-for-Automation (RF4)	Function	Functional Domain	Functional Area	Type	RF 3 Level	RF4 Level
181883	Ensure Welding is integrated in the end-to-end process for the product lifecycle for example product verification, design proving, material applications and methods related to conformance to customer specification	ENTERPRISE	Regulatory Compliance	Coordinate Compliance activities	Implement	E	E
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data	ENTERPRISE	Data Management	Perform Data Analysis	Maintain	E	E
224441	*Conduct structural analysis and modelling to determine the effects of loads on physical structures using Finite Element Analysis (FEA).	ENTERPRISE	Data Management	Perform Data Analysis	Maintain	E	E
189222	*Ensure compliance with relevant national and industry health and safety standards throughout all design activities.	SUPPORT	Health, Safety & Environment	Develop Safety Standards	Maintain	E	P
64970	Evaluate technical specifications to identify equipment or systems best suited for intended use and possible purchase, based on specifications, user needs, or technical requirements.	IMPLEMENT	Plan Operations	Plan Operations	Maintain	E	
46380	Determine required equipment and welding methods, applying knowledge of metallurgy, geometry, and welding techniques.	DESIGN	System/Equipment Design & Implementation	Select Equipment	Implement	P	A
188080	Identify constraints and capture technical requirements for robotics projects.	DESIGN	Prototype Design & Development	Validate Requirements	Create	P	E
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P	E
221510	Adapt and implement changes and best practices from other relevant industries to meet the demands in floating offshore wind structures	DESIGN	Technical Research	Research & Develop Technologies	Create	P	E
225813	Determine the buoyancy characteristics of floating offshore wind structures to assess stability during deployment.	DESIGN	Prototype Design & Development	Design Materials & Devices	Create	P	E

ID	Capability Statement – Offshore Wind Flotation Structures Design Engineer (RF3) / Senior Design Engineer, Design-for-Automation (RF4)	Function	Functional Domain	Functional Area	Type	RF 3 Level	RF4 Level
225814	Adapt structural designs to make offshore wind structures suitable for automated welding	DESIGN	Prototype Design & Development	Design Materials & Devices	Create	P	P
182516	Interpret technical specifications & drawings to establish detailed welding process controls, consumable selection, and dimensional limitations imposed to control distortion.	ENTERPRISE	Product Management	Develop Specifications	Use	P	
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.	DESIGN	Product Engineering	Create Engineering Designs	Maintain	P	
221503	Incorporate advancements in floating wind structure design to optimise performance and integrate innovative technologies.	DESIGN	System/Equipment Design & Implementation	Configure Equipment	Create	P	
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	P	
221515	Design floating offshore wind structures to meet specified safety, efficiency, and economic standards based on test data and specifications.	SUPPORT	Health, Safety & Environment	Develop Safety Standards	Implement	P	
5410	Analyse engineering drawings, blueprints, specifications, sketches, work orders, and material safety data sheets to plan layout, assembly, and operations.	IMPLEMENT	Plan Operations	Plan Operations	Maintain		A
197012	Implement digital twin technology to monitor, operate and optimise production processes.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Implement		A
221528	Manage the organisational and workforce transition by identifying processes that will move to automation.	DESIGN	Process Design & Implementation	Develop Processes	Implement		A
30530	Conduct research on robotic technology to create new robotic systems or system capabilities.	DESIGN	Technical Research	Research & Develop Technologies	Use		E
214196	Optimise finishing and coating procedures to minimise environmental impact in offshore wind energy production.	ENTERPRISE	Leadership & Strategy	Develop Sustainable Practices	Create		E

ID	Capability Statement – Offshore Wind Flotation Structures Design Engineer (RF3) / Senior Design Engineer, Design-for-Automation (RF4)	Function	Functional Domain	Functional Area	Type	RF 3 Level	RF4 Level
221522	Develop mock ups and prototypes to refine and validate manufacturing process.	DESIGN	Prototype Design & Development	Develop Prototypes	Create		E
133490	Provide information needed for the development of custom-made machinery.	DESIGN	System/Equipment Design & Implementation	Design Equipment	Use		P
181952	Define and commission the criteria for design choices and the development of sequential models (e.g. work flow, synthesis route, methods of operation) to advise and inform decision-making for policy and business needs.	ENTERPRISE	Regulatory Compliance	Design Policies and Procedures	Create		P
182749	Supervise/manage/oversee activities such as installation of automation & control equipment and industrial networks	IMPLEMENT	Service Delivery	Supervise Services	Maintain		P
188079	Plan and lead research activities to determine feasibility and applicability of automation solutions.	IMPLEMENT	Service Delivery	Research & Obtain Information	Create		P

A5.2.5 Data, Analytics & Digitalisation

ID	Capability Statement – Data, Analytics & Digitalisation (RF4)	Function	Functional Domain	Functional Area	Type	RF4 Level
206669	Verify that software processes and procedures comply with standards throughout the life cycle. These include local, national and international regulatory, legislative, customer and company standards. For example, cyber security, development, environmental, anti-bribery and corruption. Official Secrets Act, export control, safety standards.	SUPPORT	Health, Safety & Environment	Develop Safety Standards	Maintain	A
221531	Ensure data management security whilst ensuring accessibility to coordinate data packages effectively.	ENTERPRISE	Data Management	Monitor Data Governance	Implement	A
221522	Develop mock ups and prototypes to refine and validate manufacturing process.	DESIGN	Prototype Design & Development	Develop Prototypes	Create	E
224419	*Apply engineering mathematical and scientific principles to perform calculations and interpret data	ENTERPRISE	Data Management	Perform Data Analysis	Maintain	E
224441	*Conduct structural analysis and modelling to determine the effects of loads on physical structures using Finite Element Analysis (FEA).	ENTERPRISE	Data Management	Perform Data Analysis	Maintain	E
225813	Determine the buoyancy characteristics of floating offshore wind structures to assess stability during deployment.	DESIGN	Prototype Design & Development	Design Materials & Devices	Create	E
221523	Produce computer simulations to validate process flow.	DESIGN	Process Design & Implementation	Develop Processes	Create	E
189928	Apply advanced machine learning algorithms to analyse operations data.	IMPLEMENT	Manage Operations	Analyse Operations Data	Maintain	E
196784	Design operational networks and apply appropriate security products and processes in line with organisational requirements.	SUPPORT	Operator Support	Design and configure support systems	Maintain	E
203215	*Assist in the virtualisation and simulation of design, construction, and management of assets using digital engineering techniques	DESIGN	Product Engineering	Create Engineering Designs	Maintain	E

ID	Capability Statement – Data, Analytics & Digitalisation (RF4)	Function	Functional Domain	Functional Area	Type	RF4 Level
205286	*Implement data quality checks and data validation processes	ENTERPRISE	Data Management	Evaluate Data Quality	Implement	E
205626	*Utilise advanced data analytics tools to analyse manufacturing data and identify areas for improvement	ENTERPRISE	Data Management	Perform Data Analysis	Create	E
214187	Analyse data from automated welding and assembly processes for quality control	SUPPORT	Quality Control	Manage Quality Control	Create	E
221532	Ensure data compatibility between different suppliers to facilitate seamless integration of information.	ENTERPRISE	Data Management	Evaluate Data Quality	Maintain	E
195717	Implement advanced simulation tools to analyse and improve manufacturing processes.	ENTERPRISE	Data Management	Perform Data Analysis	Create	P
197012	Implement digital twin technology to monitor, operate and optimise production processes.	IMPLEMENT	System/Equipment Operation & Monitoring	Operate Equipment	Implement	P
221530	Develop and utilise digital assets for training weld equipment operators	SUPPORT	Operator Support	Train others to use equipment	Implement	P
moni	*Monitor and optimise the performance of digital manufacturing systems	SUPPORT	Operator Support	Design and configure support systems	Maintain	P

A5.2.6 Welding Technology Engineer

ID	Capability Statement – Welding Technology Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF3 Level
202881	*Lead complex maintenance or technical support activities using industrial control systems and applications	SUPPORT	Operator Support	Operate support systems	Maintain	A
46380	Determine required equipment and welding methods, applying knowledge of metallurgy, geometry, and welding techniques.	DESIGN	System/Equipment Design & Implementation	Select Equipment	Implement	A
83320	Integrate robotics with peripherals, such as welders, controllers, or other equipment.	SUPPORT	Operator Support	Design and configure support systems	Use	A
182516	Interpret technical specifications & drawings to establish detailed welding process controls, consumable selection, and dimensional limitations imposed to control distortion.	ENTERPRISE	Product Management	Develop Specifications	Use	A
202944	*Inspect weld appearance and identify defects through visual inspection after welding, and conduct non-destructive testing.	SUPPORT	System/Equipment Maintenance	Inspect Facilities & Equipment	Maintain	A
214182	Collaborate with engineers to optimise robotic welding parameters	LOGISTICS	Supply Chain Management	Work with Suppliers	Create	A
214193	Apply protective coatings and finishes to offshore wind flotation structures for corrosion resistance and durability.	DESIGN	Architecture	Design Facilities & Structures	Create	A
221508	Inspect finished products for defects, troubleshoot issues, and maintain digital quality control records for sign-off.	SUPPORT	Quality Control	Evaluate Product Characteristics & Quality	Implement	A
221505	Adapt to changing demands and new materials and methods in offshore wind structures	DESIGN	Prototype Design & Development	Select Technologies	Implement	A
221533	Establish coordinated movement to the joint for optimal welding accuracy.	DESIGN	Process Design & Implementation	Develop Processes	Implement	A
43420	Design engineering systems for the automation of industrial tasks.	DESIGN	System/Equipment Design & Implementation	Design Equipment	Create	P

ID	Capability Statement – Welding Technology Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF3 Level
210365	Provide technical guidance for optimal performance of advanced manufacturing systems, meeting service commitments.	SUPPORT	Operator Support	Operate support systems	Create	P
189260	*Identify and understand causes of typical welding defects, implementing strategies to reduce their occurrence and enhance the quality of welds.	SUPPORT	Quality Control	Manage Quality Control	Maintain	P
202945	*Interpret engineering drawings and procedures to ensure fabrication and dimensional requirements are met.	DESIGN	Product Engineering	Create Engineering Designs	Maintain	P
203111	*Integrate systems and components, ensuring proper diagnostics and testing	SUPPORT	System/Equipment Maintenance	Maintain Systems	Maintain	P
204344	*Adapt manufacturing operations to reduce environmental impact and promote waste reduction and recycling	LOGISTICS	Waste Management	Manage Waste	Implement	P
205389	*Create and maintain documentation for robotic systems design and development	SUPPORT	Operator Support	Design and configure support systems	Maintain	P
205392	*Provide technical support and training to end-users of robotic systems	SUPPORT	Operator Support	Operate support systems	Maintain	P
210349	Source materials and components for robotic equipment repair.	LOGISTICS	Inventory Management	Restore Inventories	Maintain	P
210363	Optimise robotic welding system using effective work plan sequencing	IMPLEMENT	Plan Operations	Plan Operations	Implement	P
214199	Maintain and calibrate automated welding and coating equipment to ensure consistent performance and quality.	SUPPORT	System/Equipment Maintenance	Maintain Tools & Equipment	Create	P
221504	Collaborate with cross-functional teams to address and resolve complex challenges in robotics design and implementation.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P

ID	Capability Statement – Welding Technology Engineer (RF3)	Function	Functional Domain	Functional Area	Type	RF3 Level
221516	Design software to control robotic systems for applications such as offshore wind structural manufacturing, assembly and test.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
221518	Program complex robotic systems, such as vision systems.	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P
225812	Design and incorporate safety equipment into the welding equipment design and function	DESIGN	Prototype Design & Development	Design Systems & Applications	Create	P