



# PORT ENHANCEMENTS FOR OFFSHORE WIND

Assessment of Current and Future Marshalling &  
Assembly Capacity in Scottish Ports

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# FOREWORD

*The ongoing ScotWind Leasing Round represents an important step towards delivering significant new investment in offshore renewables which are essential to meeting the Scottish Government's net-zero ambitions.*

*Forthcoming offshore wind projects, along with associated onshore works, will be among the biggest engineering and infrastructure projects in Scotland over coming years, and Scotland's ports have an essential role to play in their delivery.*

*Scottish ports have already been working closely with industry and Government to develop new infrastructure capacity with projects at planning, construction and operational stage to serve the offshore wind sector.*

*Research including by Crown Estate Scotland's 'Ports for Offshore Wind' (2020), has recognised that there remains a challenge for Scotland and its ports to develop the logistical, infrastructure and technical capabilities necessary to meet the full scale of future demand. This follow-on Report builds on the Crown Estate Scotland research and focuses on reviewing offshore wind marshalling & assembly capacity across Scottish ports. It has been prepared through detailed consultation with port operators and authorities that have been active in the sector, and which have future capacity expansion proposals.*

*It is recognised that industry requirements continue to evolve, and the dialogue between Government, developers, and ports to develop capacity is fast-moving.*

*Based on independent assessment, this Report presents a snapshot at a particular point in time (July 2021) of Scottish port capacity and the potential delivery of future port enhancements to respond to industry needs. The Report identifies and reviews port expansion opportunities as well as key challenges for the sector.*

*Further detail or follow-up enquires can be sought from the Report sponsors:*

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Port of Stornoway : Deep Water Terminal Proposal

Photo Credit: Stornoway port authority



# PURPOSE & METHODOLOGY

The Crown Estate Scotland's 2020 'Ports for Offshore Wind' study reviewed future trends and opportunities in offshore wind and the future industry spatial demand to support forecast industry needs. One of the principal findings of the study was the identification of a forthcoming capacity gap in land available at Scottish ports for marshalling & assembly activity. The CES study therefore recommended:

*“Scotland should collectively aim to increase large port capacity that is suitable for marshalling and assembly activities”*

This follow-on Report has been prepared, in detailed dialogue with port operators to identify and examine current and future capacity options for Scotland's ports which would meet known and anticipated industry requirements. It provides the evidence base and toolkit which enables a comparative review of current and potential future capacities across Scotland.

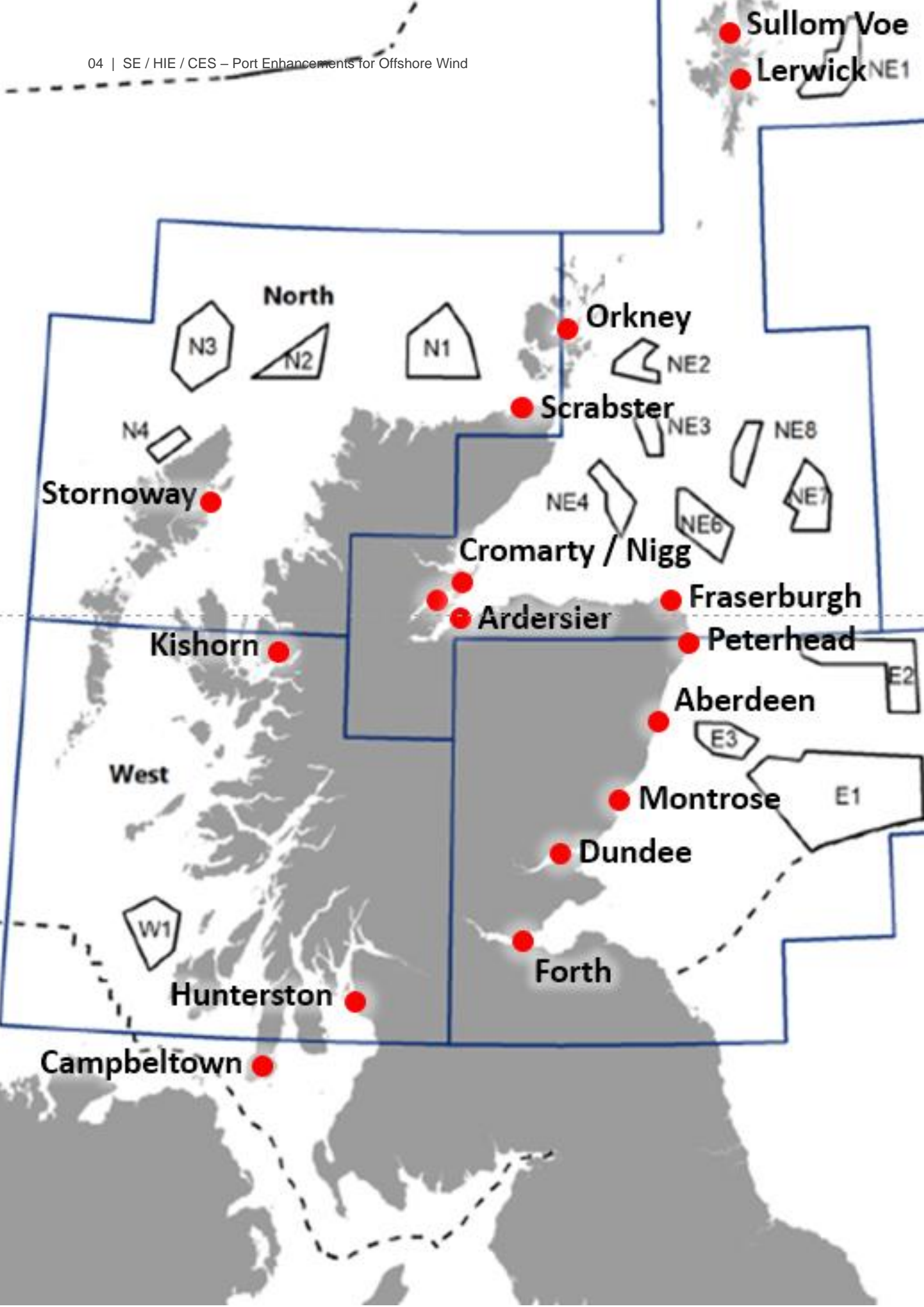
Evidence and data have been collected through direct engagement with 16 port authorities/operators covering the major Scottish ports and including different scales, geography, and port ownership structures. Engagement followed a structured interview process with port operators addressing current and future capacity, current levels of engagement with offshore wind parties, port expansion opportunities, and what factors could facilitate or hinder their delivery<sup>1</sup>. Feedback from ports was collated and developed into a model through which short-medium and longer term capacity for marshalling & assembly can be tested and future additional capacity reviewed.

While providing an independent assessment of port capacity and expansion feasibility, the report does not make direct recommendations or select preferred options. It is intended to form a basis for stakeholders in the ports sector, offshore wind industry, and public sector to engage and plan effectively as to how best to deliver future capacity and support Scotland's delivery of net zero carbon through offshore renewable energy.

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<sup>1</sup> Direct consultation / engagement was not undertaken with Ardersier, but full review of current and potential future capacity is included in reporting.





## FUTURE INDUSTRY NEEDS

The CES study<sup>2</sup> recommended that future capacity for marshalling & assembly is likely to be required in the form of sites with large laydown areas as well as quays capable of accommodating large ‘jack-up’ installation vessels. Engagement with ports undertaken for this Report reinforced that laydown area is increasingly in demand as developers seek to increase flexibility in operations and minimise risk through more onshore construction.

In a scenario of continued deployment through multiple Scotwind Leasing Rounds<sup>3</sup>, CES upper bound projections anticipate that required laydown area could be within the following range, subject to continued deployment and market / development cycles:

- 100-200ha by the late 2020’s.
- 200-300ha during the 2030’s



Future levels of demand are therefore well in excess of current capacity which has been identified by both CES and this Report as approximately 50 ha. Without coordinated action between ports, industry, and government to facilitate delivery and address this capacity gap there is a risk that:

- a lack of capacity would pose considerable challenge to the build-out of offshore wind necessary to meet zero-carbon targets
- and/or that Scotland would lose out to UK/European competitors in the construction and deployment phase of offshore wind projects (and associated benefits).

<sup>2</sup> ‘Ports for Offshore Wind’ CES September 2020

<sup>3</sup> <https://www.crownstatescotland.com/what-we-do/marine/asset/offshore-wind/section/scotwind-leasing>





***Port Infrastructure requires major Investment.***

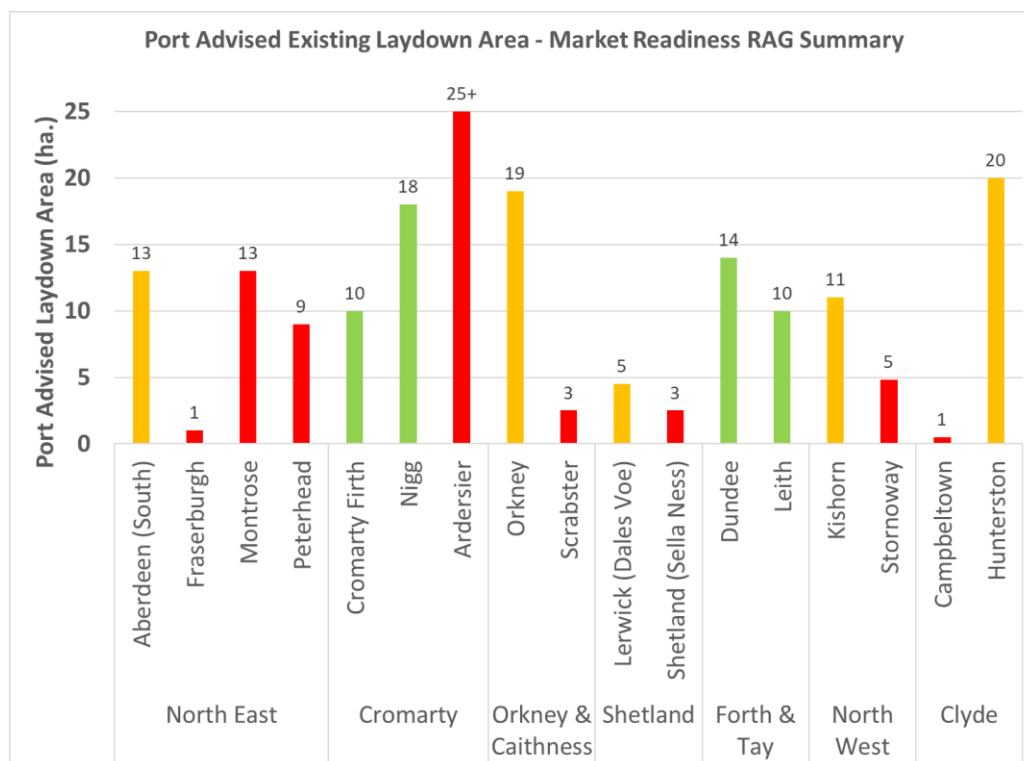
*Modest port expansion projects can cost up to £100m and more ambitious projects, such as at Aberdeen South, could cost up to £400m. Financing port development is a significant challenge.*



## CAPACITY MODEL

The Capacity Model has collated and reviewed port capacity for marshalling & assembly<sup>4</sup> (in dialogue with the selected port operators) in three parts namely: 1) existing capacity 2) planned/pipeline capacity 3) future potential capacity.

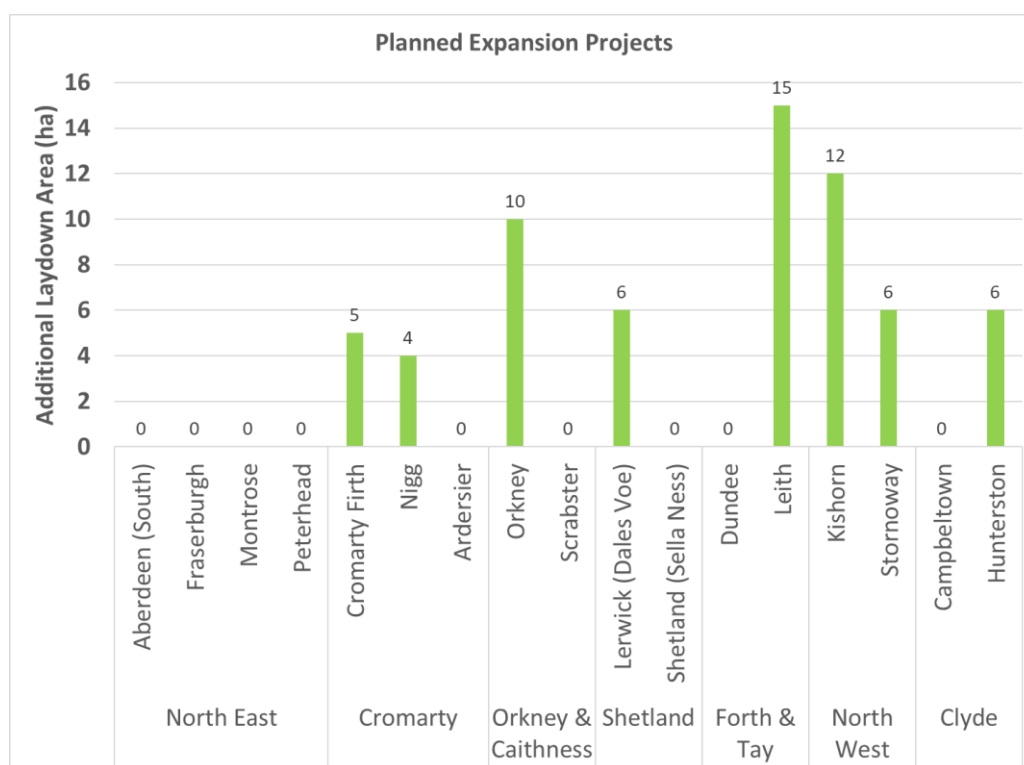
Existing capacity has been assessed in terms of market readiness and identified as **green** (market ready), **amber** (subject to further site preparation / enabling work), or **red** (unlikely to be market ready due to insufficient scale and/or potential compatibility issues associated with other port uses). As shown below, capacity which is readily available for marshalling & assembly amounts to 52ha, situated in the Cromarty Firth and Forth / Tay. A further 68ha is identified as amber capacity (Latent/Non-Operational Sites) which could become available with further investment in existing sites through preparation/enabling works. In the core model scenario, it is assumed that 50% of this pre-existing ‘Amber’ site capacity (34ha) could also become available in the short-medium term<sup>5</sup> to boost capacity.



<sup>4</sup> Laydown areas referred to in the report indicate land areas that could serve specific marshalling & assembly function. It is recognised that ports will take a more holistic view of how overall capacity can support offshore wind, including manufacturing, wider supply-chain, and other renewables activity. The laydown areas do not necessarily include all land / laydown area within respective ports, and a number of ports (eg. Leith / Hunterston / Ardersier) will have wider land areas currently used as, or identified for future use in, other renewable energy and marine industrial sectors.

<sup>5</sup> Short term 3-5 years / medium term 5-10 years

A review of planned / pipeline capacity also identified an additional 64ha in projects which are planned / consented or are developed in sufficient detail to give a confidence of feasibility and delivery in the short-medium term to boost capacity. As shown below, projects in this pipeline comprise: iterative expansion at Port of Cromarty Firth (Phase 5) and Nigg (East Quay), delivery of consented land reclamation at Kishorn, Stornoway Deep-Water Quay, Hatston Pier redevelopment at Orkney, Dales Voe (Lerwick) Ultra-Deep-Water Quay, further development of the Marine Yard at Hunterston, and laydown areas within the proposed multi-purpose Renewables Hub at Port of Leith.



Future / longer-term capacity expansion proposals were identified by most ports through direct engagement with site owners / operators. The proposals vary widely in terms of scale, the current extent of design to enable assessment of feasibility, and commitment. In many cases these represent initial ideas and concepts. The model includes a high-level review of the feasibility<sup>6</sup> of each of these port expansion options against three factors, to provide an overall assessment (scored (1-5)) of the current position against key delivery challenges

<sup>6</sup> Feasibility is based on independent assessment of emerging proposals at this point in time. Its intent is not to define the likelihood / probability of individual projects, but seeks to provide a picture of current progression / project development relative to the key challenges associated with delivering port infrastructure.



- **Technical Complexity** – port-by-port review of engineering and scale/complexity of outlined port expansion ideas based on knowledge of sites, assessment of technical requirements and dialogue with port operators.
- **Consenting Risk** – review of adjacent local, national, international designations, LDP policy / site allocation(s), and planning history. Scale of and risk profile relative to consenting aligned with regulatory requirements as reviewed with Marine Scotland.
- **Orders of Cost** – Provisional high-level cost estimates for port expansion and provision of new infrastructure benchmarked against recent investments and feasibility cost appraisals (Aberdeen South & Fraserburgh).

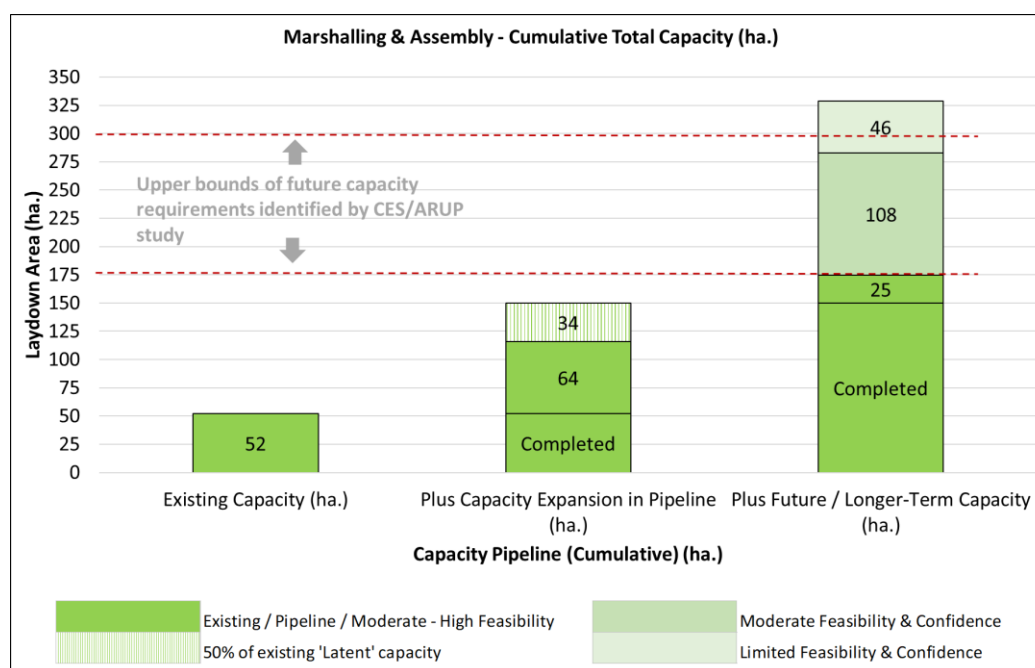
The feasibility of future / longer-term capacity expansion options, and the potential laydown area which could be delivered is summarised below<sup>7</sup>.

CURRENT OVERALL FEASIBILITY / CONFIDENCE (1-5 SCALE)	PORT EXPANSION OPTIONS	TOTAL ADDITIONAL LAYDOWN AREA
<1.5 – Very Limited Feasibility / Confidence	Montrose	20 ha
1.5-2.5 – Limited Feasibility / Confidence	Ardersier, Fraserburgh, Peterhead ,	46 ha
2.5 – 4.0 – Moderate Feasibility / Confidence	Aberdeen, Campbeltown, Cromarty, Hunterston, Leith, Lerwick, Orkney, Shetland, Stornoway	108 ha
>4.0 – Moderate-High Feasibility / Confidence	Nigg	25 ha

The modelling of existing, planned and future/longer-term capacity indicates that site capacity for Marshalling & Assembly in Scottish ports to meet ScotWind requirements as set out in the CES Report represents a major challenge. Existing and planned pipeline capacity, plus bringing forward 50% of the area of ‘Amber’ (Latent/Non-Operational) Sites (34ha) would total 150ha, still significantly short of the 175ha estimated lower threshold of potential future demand.

<sup>7</sup> NB. Dundee, Kishorn are not included in this table and subsequent engineering / consenting / cost review as a future / longer term capacity expansion option has not been identified. Current and planned capacity at both ports is counted in the overall assessment. Campbeltown and Scrabster are not included in this table and subsequent graphs as capacity expansion proposals are not capable of providing >6ha laydown area, considered the minimum requirement for marshalling & assembly.

The assessment advises that delivery of projects assessed as offering Moderate Feasibility / Confidence will therefore be necessary to reach the uppermost range of anticipated demand. Through their individual technical / consenting / cost challenges these projects carry significant delivery risk at this stage of their development, and inevitably some will prove not to be deliverable. Sites or proposals considered of Very Limited Feasibility/Confidence scoring lower than 1.5 have not been included in the table below.



In light of the significant challenge to create the required quantum of Marshalling and Assembly area across Scottish ports, the feasibility at this point in time of individual port expansion options is analysed in more detail below.



The review of engineering, consenting and investment challenges has considered current project proposals in full for each port. Individual parts/elements of proposals may have a disproportionate impact on feasibility. It is anticipated that port proposals will develop to adjust and respond to delivery risk. This review reflects understanding of proposals at this moment in time and intends to highlight relative differences in feasibility rather than definitive conclusions. Proposals assessed as having limited feasibility (eg. due to current lack of detail / design development) should continue to explore opportunities and could enhance feasibility through advanced preparatory work. Ports will continue to evolve their thinking on future development, and the challenges associated with delivery will change and be amended accordingly.



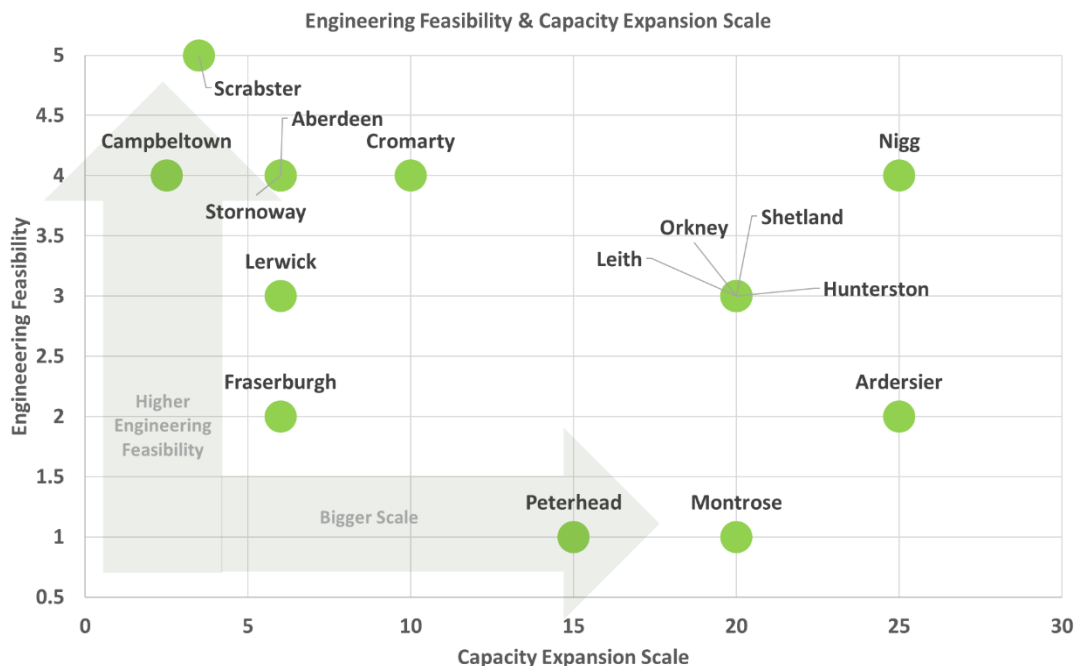
### ***Port Delivery : Require Extended Lead Times***

*Ports form major marine infrastructure projects often with associated land-side civil engineering all with significant consenting and contract requirements. Lead times are typically 5-10 years and require significant forward planning.*



# 4 ENGINEERING CHALLENGE

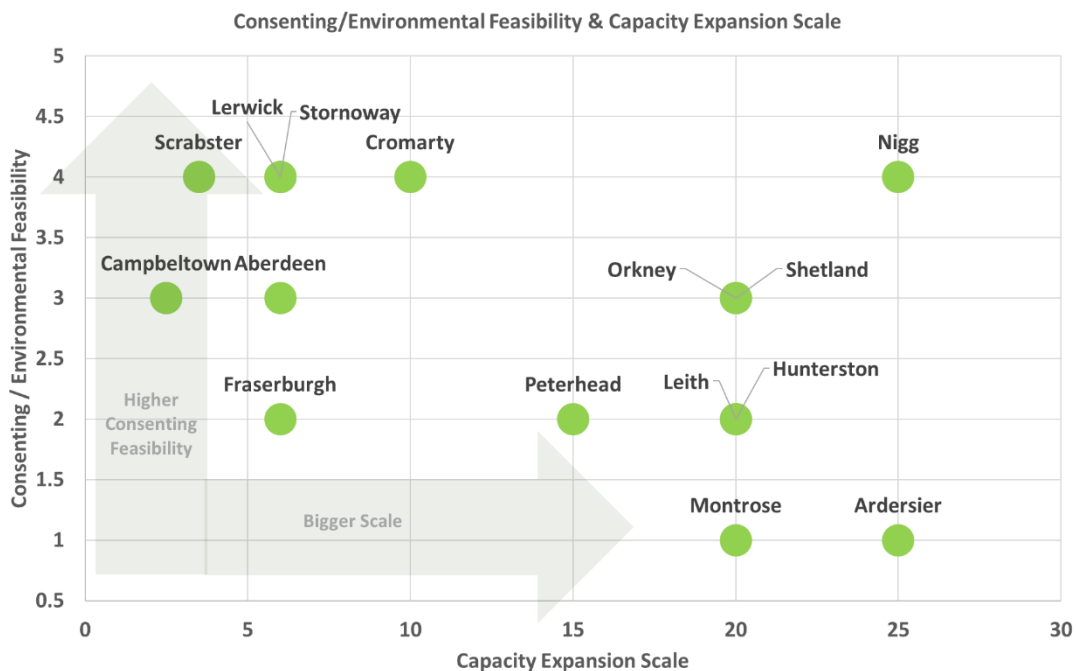
Engineering Challenges were reviewed on a port-by-port basis. The prospective scale of marine and on-shore infrastructure was considered, along with the feasibility of delivering this in terms of engineering and construction complexity.



- The majority of planned capacity expansion proposals were considered feasible in terms of technical and engineering complexity. Projects with limited engineering challenges typically involved extensions to existing port infrastructure such as **Cromarty Firth** and **Stornoway**, or conversion of existing on-shore areas to laydown such as **Nigg**. **Hunterston**, **Leith**, **Orkney**, and **Shetland** each involve a degree of technical challenge but offer potentially significant scale.
- Proposals at **Peterhead** and **Montrose** which would involve the delivery of major new port infrastructure outside current port boundaries and with the potential for greater geo-environmental impacts presented more considerable engineering challenges.
- Engineering challenges and how these are addressed is in large part a function of cost, which has been considered as a separate feasibility factor / challenge.

## CONSENTING CHALLENGE

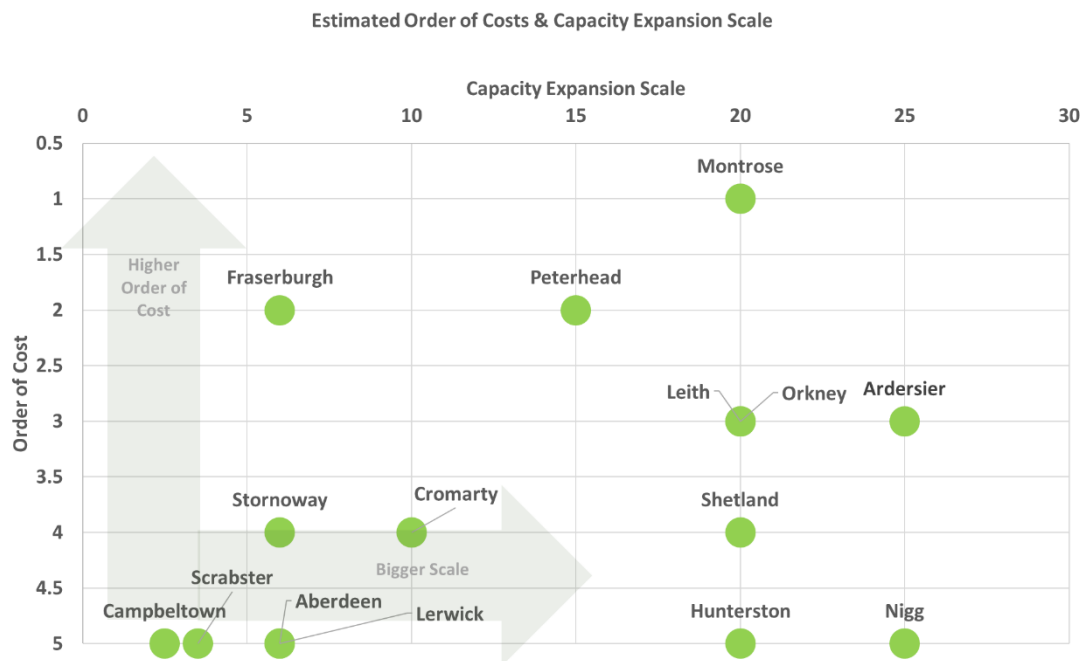
Consenting challenges were assessed through a detailed review of a port's planning history, relevant planning policy and site allocations, and potential impact on environmental designations / assets.



- **Nigg, Shetland and Orkney** have expansion capacity of significant scale ( $\geq 20\text{ha}$ ) with relative high levels of consenting feasibility – utilising significant port footprints and hinterland to create additional laydown area. This includes **Leith** and **Hunterston** subject to clarification of the consenting risk for their respective Outer Berth and Marine Yard Quay upgrade projects
- **Aberdeen, Lerwick, Stornoway, Cromarty, Campbeltown and Scrabster** have small-mid sized expansion opportunities (circa 5-10ha) with moderate and moderate-high consenting feasibility – extending existing port infrastructure.
- **Peterhead, Montrose, and Ardersier** have potential to deliver significant laydown area but more challenging in terms of consenting feasibility due to scale of infrastructure or necessary marine construction works in hereto undeveloped/protected areas or adjacent sensitive sites and/or works beyond current port boundaries with potential environmental impacts / sensitivities.

# INVESTMENT CHALLENGE

The challenge of facilitating investment to deliver port capacity expansion was reviewed by making a provisional ‘order of cost’ estimate for each port expansion project. Cost estimates were informed by benchmarked recent port engineering investment costs and included cost allowances and provision for design studies, utilities, breakwaters, dredging, quaysides. Costs provide a high-level order of magnitude comparator of relative costs



- **Orkney, Leith, Nigg, Hunterston, and Shetland** could deliver capacity expansion of scale ( $\geq 20$ ha) at relatively low orders of cost.
- **Lerwick, Aberdeen, Cromarty and Stornoway** could deliver mid-sized expansion of circa 5-10 ha at similar orders of cost.
- **Fraserburgh and Peterhead** would be capable of developing ‘new port’ infrastructure of 6-15ha at medium/higher orders of cost. While **Montrose** has the potential for major expansion it comes at the highest orders of costs.





### **Partnership Supporting Innovation**

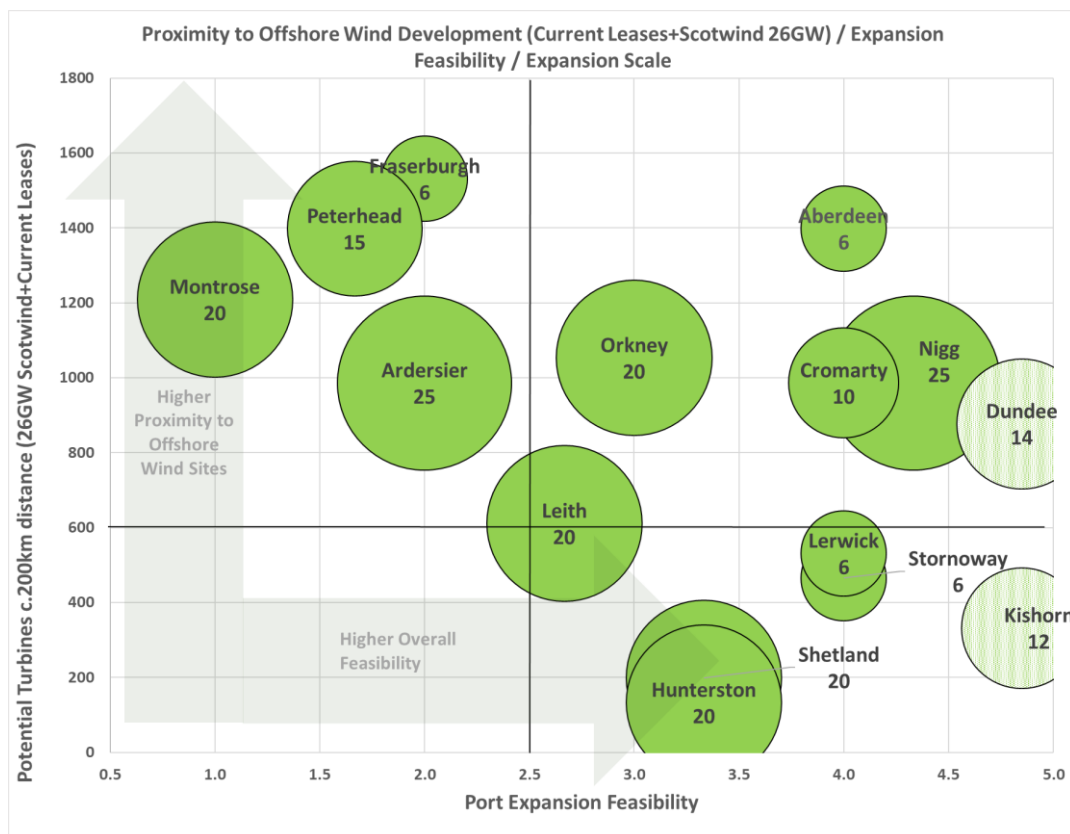
*The industry collectively needs to find effective solutions that optimise the use of assets. Partnerships and innovation will be important to delivery with port cluster collaboration and alliances will be increasingly relevant.*

## CAPACITY IN THE RIGHT PLACE

Feedback from the discussions with ports highlighted that proximity to licence sites is a key competitive advantage for marshalling & assembly ports. The short-supply of specialist vessel and developer preference to minimise offshore activity favours ports with good access to licence areas. For Scotland to compete internationally and capture the full value from Offshore Wind deployment it is important to provide port capacity in the right place.

The Capacity Model reviews overall port expansion feasibility and scale, relative to proximity to current licensed and identified ScotWind offshore wind sites (assuming realistic maximum development up to 26GW through multiple leasing rounds).

The bubbles on the plot below represent the scale (hectares) of potential future expansion, while X and Y axes respectively show overall feasibility and proximity to Leasing Zones<sup>8</sup>.



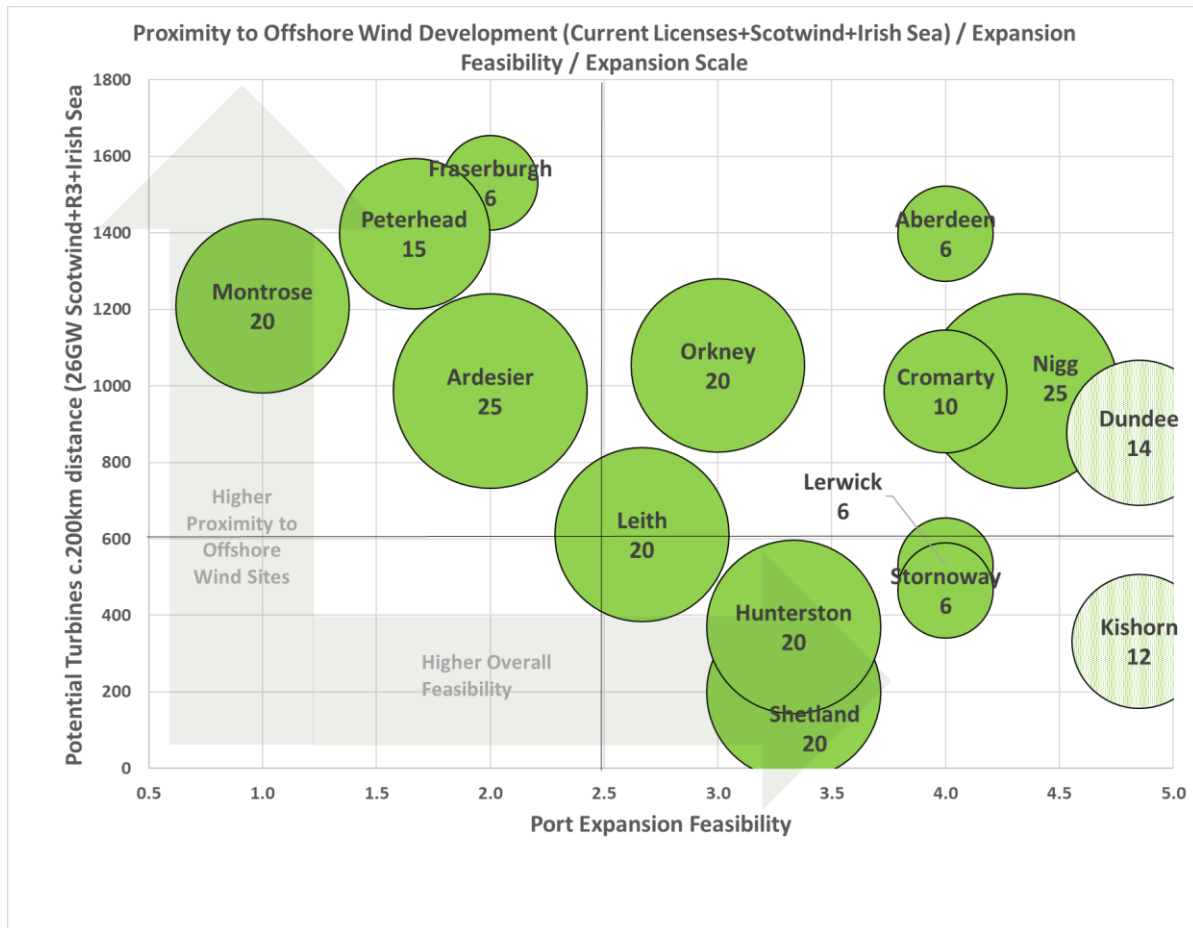
<sup>8</sup> Kishorn & Dundee are hatched as future / long-term capacity expansion option has not been identified. Currently planned capacity expansion is shown with a '5' feasibility rating as projects are consented and in the case of Dundee currently being delivered.

- **Cromarty Firth, Aberdeen, Nigg and Orkney** are proximate to future offshore wind development as well as having capacity expansion proposals of scale with relative feasibility. Expansion capacity at **Dundee** which is currently being delivered is similarly proximate.
- **Hunterston and Shetland** have significant capacity potential and relative feasibility but with current ScotWind Leasing Zones allocations are likely to see comparatively less demand for marshalling & assembly in the short-term. **Kishorn, Lerwick and Stornoway** are slightly more proximate to Scotwind Leasing Zones, and each have planned projects with feasibility for further expansion potential.
- **Montrose, Peterhead and Fraserburgh** are well positioned and offer potential scale but pose challenges in terms of feasibility in order to deliver capacity expansion.
- **Leith's** emerging Renewables Hub proposals have been well publicised and can deliver significant new multi-purpose areas (up to 75ha) with manufacturing / fabrication capabilities as well as other renewables activity. This could include significant new marshalling & assembly capacity for offshore wind, proximate to current and future North Sea Leasing Zones. The principal challenge relates to development of an outer-berth beyond current lock entrance.
- **Ardersier** has a significant footprint and potential laydown area, and is proximate to offshore wind sites in the Moray Firth. Notwithstanding large area, there are potentially significant consenting challenges to secure a dredge depth of greater than 6.0mCD. Review has identified that the port could still play a significant support role to a North-East ports cluster, utilising large laydown area for wider multi-functional activity associated with marshalling & assembly such as cable-storage, chains & anchors, sub-sea mattresses and other structures and as a component assembly/manufacturing base.

To model impact on ports which are more remote from ScotWind Leasing Zones but could seek to export capacity elsewhere, Irish Sea leasing zones (including Round 4) which could be serviced from Scotland's west-coast are included (albeit slightly more than 200km in sail distance).



With this factored in, **Hunterston** would benefit from higher levels of potential demand and move closer towards the centre of the plot. This is shown on plot<sup>9</sup> below.



Finally, in considering how Scotland can develop an industry responsive relevant offer it is important to recognise that wind developers are seeking ports and infrastructure partners to collaborate and find innovative solutions that minimise risk, reduce costs and optimise delivery.

Optimising existing and future capacity should encourage both geographic '**cluster submissions**' and '**port alliances**' that deliver against the varied contract needs of industry (marshalling-assembly /pre-deployment services / storage- cabling /etc alongside skills, expertise, deployment track-record, relationships, etc. Potential indicative geographic clusters are illustrated and these may be extended by wider alliances linking all ports with capacity and capability to service this sector. Cluster opportunities and links to Leasing Zones to which they could provide marshalling & assembly is shown overleaf.

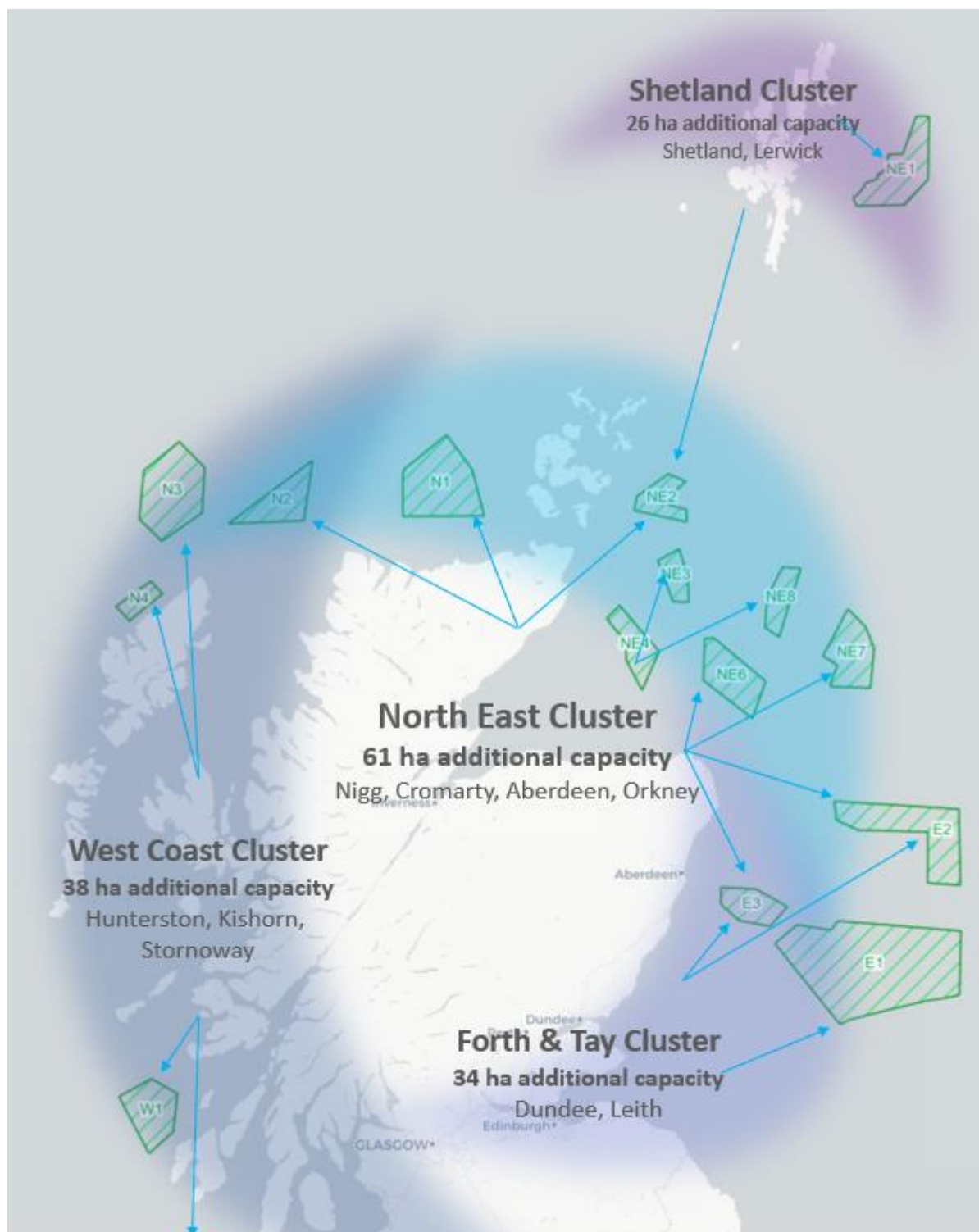
<sup>9</sup> Additional seabed leasing zones are Crown Estate 'Round 4' Projects 4, 5, and 6, Isle of Man Orsted Offshore Wind Project, and Republic of Ireland 'Relevant Projects' at North Irish Sea Array, Clougher Head, and Oriel.

Offshore wind and floating wind operation and deployment remains a new and challenging industry. Cost, contract obligations and operational needs will drive innovation with operators adapting approaches, technologies and deployment techniques to reduce cost and improve resilience / performance / contract assurance. Adaptation and change to industry port infrastructure criteria along with stronger partnering arrangement can be expected and will continue to shape the port/wind developer relationship going forward.

- **North-East Scotland Cluster** – Nigg, Cromarty, Aberdeen and Orkney are all well positioned relative to ScotWind Leasing Zones across the North Sea and Moray Firth and benefit from feasible long-term expansion options. There will be high demand for marshalling & assembly laydown area in these locations.

Expansion at Ports of Montrose, Fraserburgh, Peterhead pose challenges but could be realised to further boost cluster capacity or continue to play supporting role in accommodating displacement activity and wider offshore wind servicing needs.

- **Forth & Tay Cluster** - Leith and Dundee are well situated in close proximity to North Sea Leasing Zones and boast existing capacity for marshalling & assembly as well as future expansion opportunities, including manufacturing / fabrication capabilities as part of Leith Renewables Hub. The Cluster can also benefit from support and additional servicing functionality from Forth Ports wider portfolio at Burntisland, Rosyth, Methil, Grangemouth
- **West of Scotland Cluster** – A wider West of Scotland Cluster between Hunterston, Kishorn and Stornoway could emerge to meet demand from Leasing Zones W1, N1-4 and explore potential export opportunities to Irish Sea offshore wind. Campbeltown and other west-coast ports may also provide additional support services (O&M) within this cluster.
- **Shetland Cluster** – Despite relative remoteness from ScotWind Leasing Zones, Lerwick and Shetland (Sullom Voe) have potential to expand ports with deep-water access which is well-suited to floating wind and could provide specialist functionality.



*Promoting Cluster Capacity and Port Alliances*







## STEPS TOWARD DELIVERY

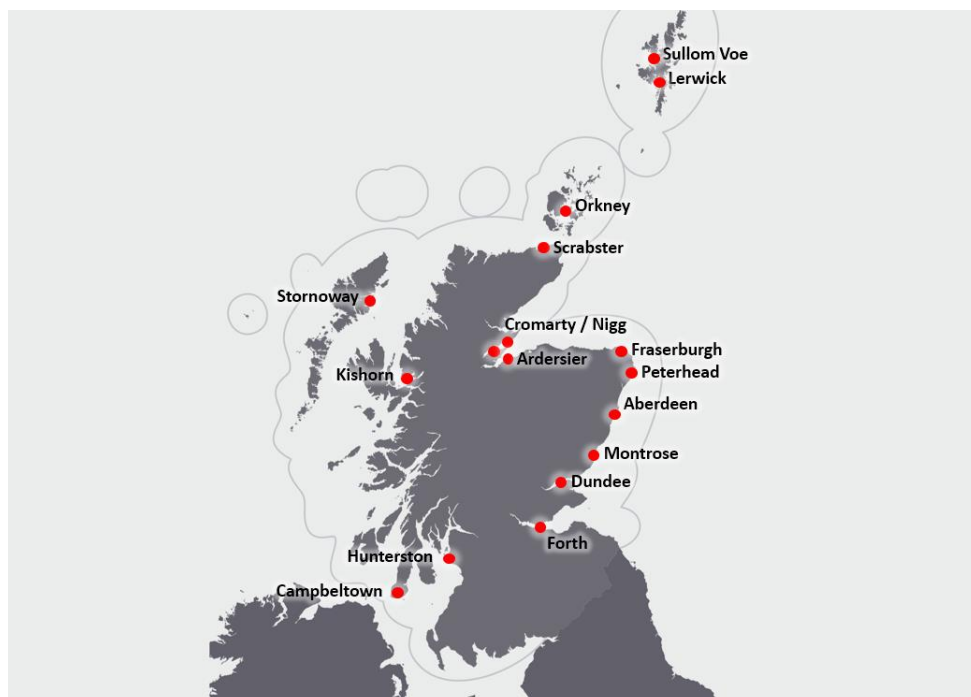
The Report has independently assessed current and potential future capacity, as well as a high-level feasibility of expansion options across the major Scottish ports. It has identified locations where additional capacity could be delivered and reviewed these relative to current orders of cost, consenting, and proximity to licence areas. This should serve as a basis for further review and engagement between key stakeholders to consider what might be the most appropriate mechanisms to facilitate delivery of both a 21<sup>st</sup> century port infrastructure and the capacity to meet Scotland's net zero targets.

The Report does not provide direct recommendations, but does draw the following broad conclusions and potential outline of the next steps:

- Ports are actively engaged in the offshore wind industry and there is an established dialogue between ports and developers to understand future needs and opportunities;
- The main ports are already planning and investing in the offshore wind opportunity and there has been significant advancement made in the last decade through port expansion such as Aberdeen South, Port of Cromarty Firth, Nigg, Leith and Orkney which are capable of meeting future marshalling & assembly demand.
- A significant challenge exists for the industry including developers, ports and public-sector partners to secure the marshalling & assembly capacity necessary to meet the offshore renewable capacity requirement which are likely to range between 175ha-300ha (upper bound projection) by 2030.
- Ports represent long-term infrastructure assets. Typical timescales from concept to consents, contracts and operation is 10+ years. Additional new capacity cannot be turned around within short timescales and forward planning and collaboration across the industry will be required to address future requirements.

- To address this future need there needs to be significant investment in project scoping, feasibility and design studies and including identification of wider financial/commercial support mechanisms to accelerate and support essential investment. To align with anticipated industry deployment requirements port expansion in the most in-demand areas will need to be *‘procurement - contract ready’* within 5 years in order to be operational in 2028-2030. These are already challenging timescales.
- Current orthodoxies and requirements for marshalling and assembly are evolving in response to innovations (eg. floating wind), which will result in further demand and premium on laydown area as developers move construction activity onshore wherever possible. Development of capacity will need to be adaptable and capable of adjusting to increased scale and complexity requirements from industry.
- Partnership activity – whether in geographic clusters or wider alliances needs to be positively encouraged to create industry responsive ‘whole project’ solutions , that builds on complementarities, makes best use of assets, adds competitive advantage and delivers additionality to all participants and stakeholders.

In addition to optimising use of physical assets, partnerships and collaborations could offer a strong competitive advantage to Scotland and the port sector.



**Map of Scottish Ports reviewed for Marshalling & Assembly capacity**