

NAVIGATING MARITIME INNOVATION

IN THE LIVERPOOL CITY REGION

LIVERPOOL CITY REGION THE UK'S LEADING MARITIME INNOVATION POWERHOUSE

Mersey Maritime



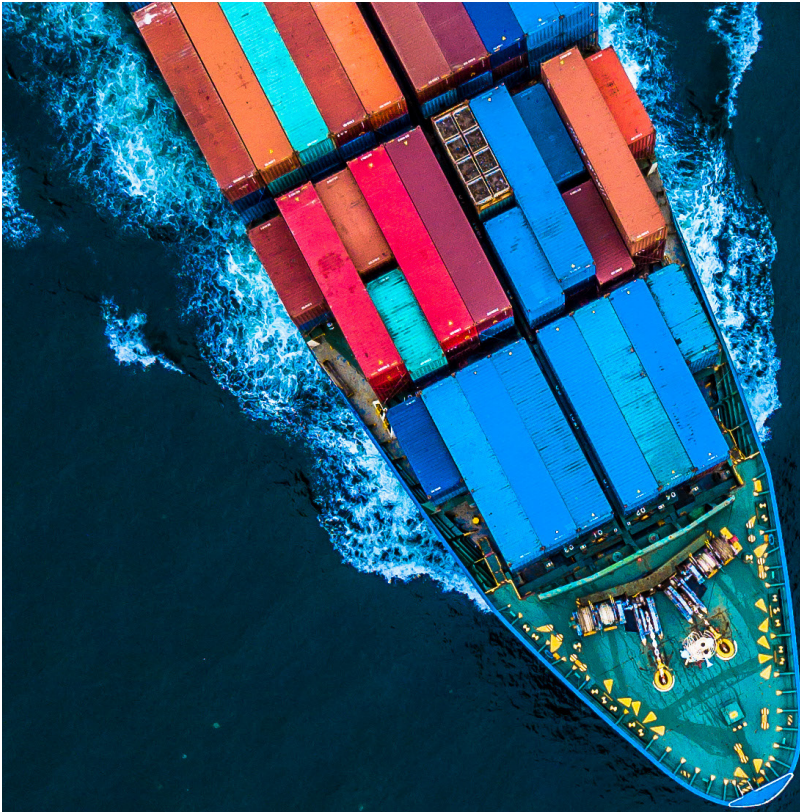
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1. FOREWORD

FROM RUTH WOOD, CEO AT MERSEY MARITIME

Mersey Maritime has led an industry driven programme examining critical innovation across the maritime sector within the Liverpool City Region (LCR). Supported by the Department for Transport's Maritime Cluster Development Fund, the Navigating Maritime Innovation (NMI) project has assessed the region's existing strengths, technological capabilities, and emerging opportunities across both the LCR and the wider North West.

Our findings identify a globally significant maritime innovation ecosystem, characterised by deep research expertise, advanced industrial capacity, a highly skilled workforce, and a strong culture of collaboration. Partners from industry, academia, and the technology sector have contributed evidence-based insights and forward-looking proposals that collectively position the LCR as one of the most innovation dense maritime regions in the United Kingdom.

The project illustrates the breadth of this regional capability, highlights key innovation assets, and promotes opportunities for collaboration and investment to both national and international audiences.

This work has been delivered in partnership with leading industry and academic organisations, including: APCL Cammell Laird, Bibby Marine, Haskoning, Liverpool John Moores University (LJMU), the Manufacturing Technology Centre (MTC), Peel Ports Group, and the University of Liverpool.



2. EXECUTIVE SUMMARY

The LCR possesses one of the UK's most advanced and fast evolving maritime innovation ecosystems. Through the NMI programme, 188 innovation projects have been mapped across industry, academia, and new market entrants, with a combined pipeline valued in the region of £1.9bn. This activity reflects a sector that is not just preparing for transformation, it is already delivering it.

The LCR combines deep maritime heritage with modern capability, world class assets, and a rapidly expanding innovation ecosystem. From being home to the world's first commercial wet dock in 1715, becoming a strategic global gateway, world leaders in shipbuilding, offshore operations, ocean science and clean energy - Mersey Maritime's NMI project has highlighted a modern and concentrated cluster of leading maritime capability.

The evidence collected demonstrates that the LCR is not simply a testbed for maritime innovation, but a strategically positioned powerhouse capable of shaping the UK's clean, digital and globally competitive maritime future. Even if partially realised at this time, this portfolio could rapidly steer an innovation growth trajectory and regional inflection points of strategic change.

This emerging evidence base will guide the next phase of collaborative maritime R&D, funding bids, innovation pilots and capability mapping; ensuring that the region continues to lead the UK's transition towards a cleaner, smarter, and more competitive maritime economy.



Key findings include:

£1.9bn

INNOVATION PIPELINE

£1.9 billion with 57% of projects currently in delivery or during the next 12 months. 28% over the course of 12-24 months, 15% 2-5 years.

ADVANCED TECHNOLOGY MOST PREVALENT

68% of responses with AI, digitalisation, 5G, cloud integration, automation and autonomy as capability.



DECARBONISATION AND FUTURE ENERGY

21% of responses identify carbon capture and clean infrastructure directly. Hydrogen, hybrid, nuclear and e-methanol were also key areas of innovation focus. 91% of organisations open to collaborative partnerships (SMEs, primes, ports, universities, RTO).



SECTOR VERY RECEPTIVE TO COLLABORATION

91% of organisations open to collaborative partnerships (SMEs, primes, ports, universities, RTO).



MARITIME SUBSECTOR FOCUS

42% of projects target port systems; very closely followed by 41% vessel innovation (manned & unmanned).



REGIONAL PRODUCTIVITY

95% of projects linked to hiring/upskilling, tackling LCR's productivity challenge. With opportunities in port and shore side the majority.

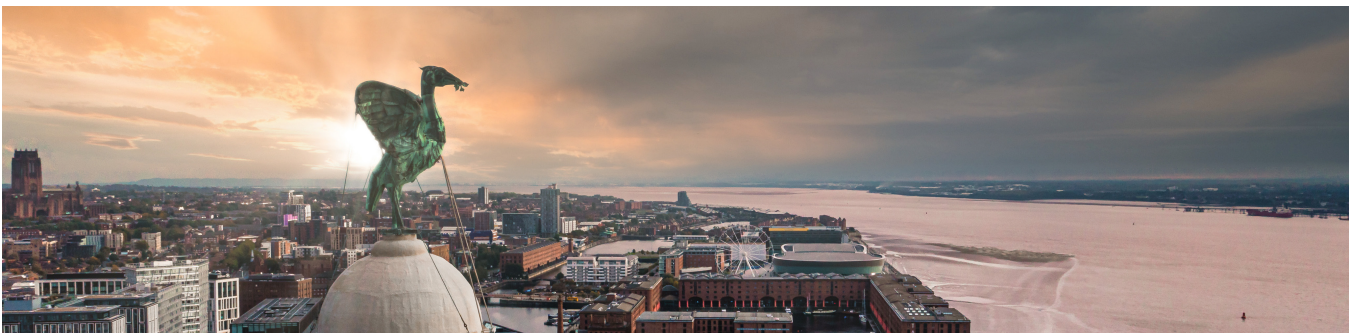


INVESTMENT SPECTRUM

From early-stage study projects 50k-£1m (37%). Mid-range projects: £1m-£10m accounting for 21% and potentially transformational ventures identified from £10m upward of £300m, representing 17%.

FUNDING AWARENESS

A quarter of projects were unsure of funding options, identifying greater need for grant and funding initiative awareness. If known, our NMI estimate would be comfortably above £2bn.





3. PROGRAMME OVERVIEW & METHODOLOGY

The NMI programme has captured critical insights from across the LCR and the broader North West maritime sector. Our objective was to understand the sector's current capabilities, future ambitions, appetite for innovation, what is in place now, and what could be possible with the right collaborations and support in the future.

3.1 STAKEHOLDERS

To achieve this, we engaged a diverse cross-section of stakeholders, categorised into five key groups:



Owners and operators of ports, logistics infrastructure, offshore assets, and vessels.



Maritime-specific manufacturers, whose products directly serve the sector.



Cross-sector manufacturers with transferable capabilities that can be adapted to benefit maritime.



Academic institutions and SME experts, including those developing technologies with either a direct or potential application in maritime.



Local authorities and public sector bodies, offering a strategic lens on policy, regulation, and global market trends.

This broad and inclusive approach allowed us to identify both capability gaps and innovation opportunities. Crucially, it has revealed clear points of alignment between the needs of larger maritime businesses and the specialist capabilities of SMEs and academic institutions, offering a fertile and thriving basis for collaborative innovation.

Significant in-sector innovation is already underway. Organisations such as Peel Ports and Bibby Marine have dedicated transformative technology specialist teams tackling challenges ranging from decarbonisation to digital transformation.

This broad and inclusive approach allowed us to identify both capability gaps and innovation opportunities. Crucially, it has revealed clear points of alignment between the needs of larger maritime businesses and the specialist capabilities of SMEs and academic institutions, offering a fertile and thriving basis for collaborative work, and informing the narrative around our resulting recommendations. These sessions focused on industrially prescient topics, including:

- The development of Small Modular Reactors (SMRs) and the application of nuclear technologies within maritime environments.
- Hydrogen production, storage, and distribution through initiatives such as the HyNet North West project.
- Port digitalisation and the futureproofing of maritime infrastructure and operations.
- Defence capability in the context of evolving geopolitical dynamics, and the LCR's resilience and capacity to adapt.

3.2 THEMATIC FOCUS

The project was structured around four core innovation themes:



DECARBONISATION



ADVANCED TECHNOLOGY



FUTURE ENERGY



STRATEGIC POSITION

Each section of this report outlines the number of opportunities identified, funding needs, collaboration openness (including SME engagement), and key productivity or capability challenges.

Although presented separately, many themes naturally overlap. For example, digital and AI tools often generate system wide efficiencies that positively impact decarbonisation. In these cases, projects have been grouped under their most relevant primary impact.

All data has been anonymised under GDPR, unless consent has been given to share.



4. KEY FINDINGS

Our methodology has produced a comprehensive maritime innovation dataset for the LCR.

Across 188 innovation projects, the region demonstrates:

30+

Decarbonisation initiatives

64+

Digital, automation and AI systems projects

20+

Future fuel and clean energy proposals

71+

Advanced manufacturing and vessel-design projects



Productivity and skills findings

This evidence base shows a sector aligned with the LCR Growth Plan, the Maritime Innovation Action Framework and the government's Clean Maritime Plan (originally published in 2019).

4.1 STRONG PIPELINE OF INVESTMENT DELIVERY

The project has identified a strong and expanding investment landscape:

- 36 early-stage projects in the **£250k-£1m** bracket, totalling approximately **£7.3m**.
- 36 Projects in the **£1m-£5m** bracket, totalling approximately **£145m**.
- 4 Projects in the **£5m-£10m** bracket, totalling approximately **£35m**.
- 14 Projects in the **£10m-£20m** bracket, totalling approximately **£264m**.
- A substantial portfolio of 17 Projects above **£20m** (ranging up to **£400m**), totalling an estimated **£1.4bn** in transformative bids aligned to decarbonisation, digital infrastructure and offering a future fuel roadmap for the region.
- Major region-shaping programmes such as: Stanlow Manufacturing Complex, a key regional hub for UK's energy transition and its terminals situated in the LCR Freeport zone, and linked to emerging opportunities such as the HyNet project.

The pipeline reflects a region with both the ambition and commercial readiness to scale.



4.2 DISTINCTIVE WORLD LEADING CAPABILITIES

Our data reinforces a consistent trend in the region which demonstrates advanced technological capabilities, uniquely positioned to deliver national-scale maritime change across:

- Ports, shipbuilding, energy, Defence, logistics, vessels, digitalisation and manufacturing.
- Industry leaders spanning port operations, offshore service vessels, Defence manufacturing, environmental modelling, and clean energy.

This combination of assets is unmatched elsewhere in the UK. It sits alongside a rare concentration of R&D centres, such as: SciTech Daresbury, Hartree Centre, STFC Daresbury, and Glass Futures, together with supply-chain integrators and specialist maritime SMEs.

4.3 PIVOTAL INNOVATIONS ALREADY IN MOTION

- Offshore wind and marine renewables.
- Hydrogen and ammonia fuel infrastructure.
- Digital port systems, advanced autonomous systems and AI-enabled logistics.
- Next-generation vessel capability and hybrid operations.
- Advanced manufacturing, composites and naval engineering.

These projects align directly with the themes of our project which demonstrate the real-world industry-led commitment to innovation and a consistent privately funded roadmap of meaningful impactful change, in addition to aspirational activity which has the potential to further boost the local economy if realised.

4.4 OPEN INNOVATION ECOSYSTEM

The region's maritime sector shows clear openness to collaboration and awareness of the necessity to do so. This corresponds with the region's openness across other industrial clusters too, formally convened or diffuse amongst the wider regional ecosystem, including advanced manufacturing, energy and net zero. Across our engagements, companies consistently expressed:

- A desire for shared R&D programmes.
- Commitment to clusters and cross-sector innovation.
- The need for skills development in digital, systems engineering and clean energy.
- Appetite for future-fuel transition, digital integration, and infrastructure upgrades.

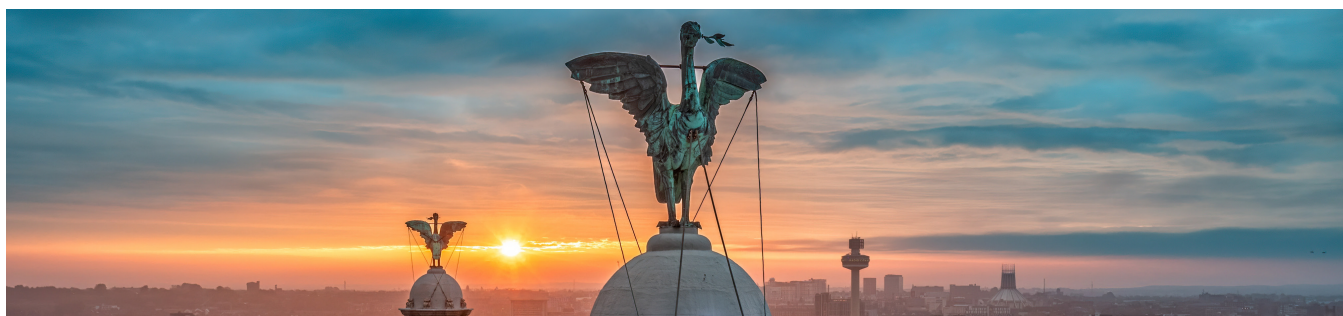
4.5 A NATIONAL SPRINGBOARD FOR CLEAN MARITIME INITIATIVES

The data highlights substantial momentum in decarbonisation:

- Shore power readiness.
- Electrification of ports decoupling from grid power.
- Hydrogen, methanol and e-methanol, and ammonia pathways.
- Emissions optimisation and major efficiency increases through digital twins and the utilisation of AI technologies.
- Offshore renewable service integration.

The LCR is positioned to become the UK's leading clean maritime cluster, spearheading national objectives and supporting industry transition.

Realising even a portion of some of the opportunity contained within this proactive and thriving sector will not only strengthen the region, but it will also contribute to reinstating the UK's position as a global maritime innovator.





5. STRATEGIC POSITIONING AND THE IMPORTANCE OF MARITIME

5.1 ECONOMIC IMPACT

In 2025, Liverpool John Moores University commissioned a refresh of a maritime industry-focused economic impact study through the Centre for Economics and Business Research (Cebr). In reference to this analysis, the NMI project findings sit at the heart of a rapidly expanding LCR maritime sector.

Key findings:

-  In the North West, aggregate sector turnover growth from **£5.6bn** in 2023 to **£9.03bn** in 2025, supporting **47,773 jobs** across the region when indirect and induced effects are included.
-  Directly within the LCR, the sector employs **10,901** people and generated **£3.40bn** in turnover and £1.16bn in GVA in 2025, with average annual GVA growth of 12.6% since 2023.
-  Shipping and maritime business services together account for over **74%** of direct GVA, with shipping alone contributing **40.3%**.
-  Maritime productivity remains significantly above benchmark levels, with GVA per employee **45.2%** higher than the UK average and **67.4%** higher than the wider LCR economy.
-  The sector has sustained employment growth averaging **9.1%** per annum since 2023, significantly outperforming UK-wide trends.
-  The Port of Liverpool continues to anchor this performance, handling **£11.5bn** in exports and **£16.9bn** in imports in 2024, with import growth of 11.3% year-on-year and trade values substantially exceeding the UK port average.
-  For every direct maritime job, a further **3.38 jobs** are supported across the regional economy, and every £1 of direct turnover generates an additional **£1.65** in wider North West activity.

By strengthening connectivity, skills, digital adoption and decarbonisation pathways, the NMI project directly reinforces these growth drivers, supporting the continued expansion of high-value maritime employment, productivity, and trade competitiveness in the LCR.

To read the full economic impact report click [HERE](#).

North West Maritime Economy

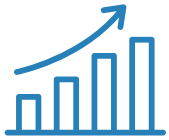


Worth
£9.03 billion
through business turnover



47,773
jobs supported

Liverpool City Region Maritime Economy



18.6% growth
in direct employment 2023-2025



£3.40 billion
direct turnover



GVA productivity of workers
67.4% & 45.2%
higher than wider LCR higher than UK average



11.3% import growth
at the Port of Liverpool year on year, above the UK average

Economic Drivers



3.38 jobs
for every job created by the sector



£1 = £1.65
turnover wider economic activity



5.2 LCR FREEPORT

The LCR is one of 12 government-designated UK Freeports, where a range of economic incentives are being deployed covering customs, business rates, planning, regeneration, innovation and trade and investment support. The NMI project directly interacted with the Freeport Innovation Challenge Fund Challenge (Summer 2025) and helped to guide multiple businesses with innovative ideas towards applying for grant funding support. This helped streamline the process and, for those successful applicants, enabled speedier implementation and co-development of critically important new innovations.

The NMI innovation pipeline also maps strongly onto ongoing Freeport and Innovation Zone (ISZ) development because a significant proportion of projects, particularly those in decarbonisation, port efficiency, clean energy systems and future fuels, fit squarely within the Freeport's objectives for green growth, advanced manufacturing, and seamless trade.

The rise of high-investment, high-complexity initiatives, many of which are aligned with academia and cluster anchors, provides a potentially ready-made portfolio for ISZ deployment, particularly where infrastructure, R&D assets, and high-skill labour mobility are critical. This strengthens the case for the Freeport/ISZ model to be used as a platform for accelerated testing, permitting, and commercialisation of maritime technologies. With potential subsequent rounds to be announced of the Freeport Innovation Challenge Fund, the NMI project has shown that there is a clearly pre-validated and healthy pipeline of future successful applicants within the maritime innovation ecosystem already in existence.

5.3 LCR LOCAL GROWTH PLAN

Capturing a pipeline of 188 innovation projects across industry, academia, and new market entrants, demonstrates that the maritime sector is one of LCR's most innovation-dense domains.

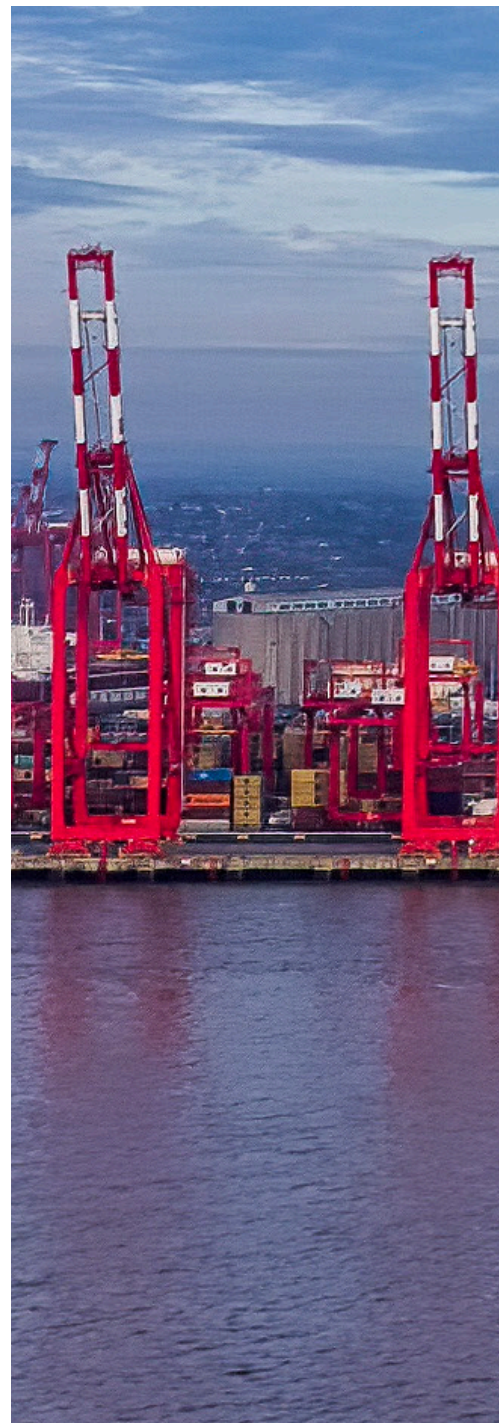
The scale and maturity of these projects directly support the LCR Growth Plan's 2025-2035 vision, providing a clear, evidence-based pipeline that can be aligned to the Plan's priority missions: net zero, innovation-led growth, advanced manufacturing, clean energy, and port-centric productivity. The significant shift towards higher investment projects in the NMI portfolio shows a sector preparing to deliver large-scale transformations, offering the basis for a structured investment deck that can meaningfully contribute to the Growth Plan's R&D and GVA ambitions.

5.4 NATIONAL AND INTERNATIONAL IMPACT

The NMI project aligns directly with Maritime 2050 (2019), the UK's long-term vision for a competitive, productive, and environmentally leading maritime sector. The project's findings also reinforce the delivery priorities of the Clean Maritime Plan, which calls for accelerated investment in future fuels, digital optimisation, vessel efficiency, and green port infrastructure. Therefore, the thematic areas of our innovation ecosystem and the 188 representative projects captured through NMI are closely aligned with Maritime 2050.

With the UK SHORE funding announcement (September 2025, £448 million) and confirmation of the Clean Maritime Demonstration Competition 7 (CMD7) and Zero Emission Vessels and Infrastructure (ZEVI2) competitions (March 2026, £271 million), signalling the next wave of national support for clean maritime technologies, the LCR is uniquely well placed to act as a high-readiness testbed for demonstrator projects. Many of the NMI's identified projects are within the medium and large-scale range, particularly those in electrification, hydrogen/ammonia fuel systems, port-side digital infrastructure, autonomy and advanced vessel design, and align precisely with the funding priorities of CMD7, for example.

Together, these national programmes underscore the importance of the NMI project: it provides the evidence base, industry mobilisation, and strategic direction needed to ensure the LCR can not only participate in these national missions but also lead them.



5.5 SKILLS AND WORKFORCE IMPLICATIONS

The NMI findings carry major implications for the region's skills programmes, including the Local Skills Improvement Plan (LSIP) and the L6.20 skills commitment: ensuring that skills provision is directly aligned to employer demand.

With over 95% of organisations reporting either hiring needs, upskilling requirements, or both, the evidence shows accelerating demand for higher-technical, digitally literate, and specialist engineering skills. This correlates directly with the LSIP's priority sectors of advanced manufacturing and digital energy systems, highlighting where targeted curriculum development, talent pathways, apprenticeships, and employer-designed training interventions will be required. Conversely, there is also opportunity developed through some of the projects identified in NMI which can widen the demographic to those less skilled, making a more inclusive future work force possible.

As higher-investment and higher-technology projects grow, the LCR's skills system will need increased support for data science and AI, autonomy, composite materials, power systems, alternative fuel handling (including small modular reactors), environmental analytics, and maritime cyber disciplines. These insights provide actionable routes for LSIP, L6.20, and employer partnerships to strategically shape the future workforce.

5.6 PRODUCTIVITY

The NMI dataset also directly strengthens the LCR's stated 'Productivity Mission' prioritisation. The scale, maturity, and mostly privately co-funded nature of the estimated £1.9bn innovation pipeline identified, provides a strong basis for inferring future productivity and GVA impacts. The concentration of projects in advanced technologies, decarbonisation, and energy systems - sectors with historically high GVA per worker - suggests potential firm-level productivity uplifts in the range of 5 -15% over the delivery lifecycle. Assuming conservative deployment and standard sector multipliers, the pipeline could support an additional £150m-£350m in regional GVA over the medium term, reinforcing the LCR's trajectory of above-average maritime sector growth.

The scale of private sector suggests that a significant proportion of the identified innovation pipeline is commercially driven and likely to translate into operational deployment, increasing confidence that productivity and GVA impacts will be realised rather than remaining speculative. The evidence suggests that maritime innovation can unlock substantial productivity gains within high-value logistics corridors. These innovations not only increase efficiency, but also enable scalable exportable services, supporting the region's aim of creating higher-skilled, higher-productivity employment clusters.





6. ADVANCED TECHNOLOGY AT SCALE

Advanced technology was the primary area of submission focus in the NMI dataset. Understandably this is a broad category which touches on many disparate and complementary capabilities. An estimated £886m in potential and in-flight projects has been identified across the NMI evidence gathered.

6.1 SCALE AND COMPOSITION OF ACTIVITY

Large corporate entities account for approximately 70% of total project value in this theme. Projects consistently show major capabilities in:

-  AI operations
-  Predictive maintenance
-  5G cloud integration
-  Energy system transition

This sector is also a primary focus of HEI expertise and innovation: approximately 25% of Advanced Technology projects originate from Higher Education Institutions, equating to a portfolio of roughly £200m in innovation-led activity. These projects are frequently predicated on large corporate collaboration and structured academic-industry mechanisms such as through the Maritime & Last Mile Place Based Impact Accelerator Account project (MaLaMi PBIAA) and the Net Zero Maritime Energy Solutions (NOMES CDT) programme with 38 industry-funded, fundamental research projects.

Within this theme, the NMI dataset clearly demonstrates opportunity for structured cross-collaboration across organisational scale. Smaller specialist capabilities are directly complementary to large corporate transformation agendas, particularly in:

- Digital twin integration and asset performance modelling
- Autonomous and semi-autonomous systems deployment
- Inspection, fabrication and maintenance
- Smart energy management and load optimisation systems
- Data architecture, interoperability and unified command environments

The open innovation ecosystem of the LCR is highly active and interactive here. It is structurally evidenced through capital distribution, funding behaviour, and thematic alignment.



6.2 ADVANCED TECHNOLOGY IN LARGE CORPORATE ENTITIES

6.21 MARITIME TRANSPORT – LOGISTICAL SAFETY AND DIGITAL PROCESSES

Through the NMI survey, Maritime Transport identified two complementary advanced technology concepts focused on operational efficiency and driver welfare within port and landside logistics environments.

The first centres on container unloading optimisation, exploring smart visual connectivity and remote-release systems that would enable drivers to unlock and de-load containers without leaving the cab. By integrating intelligent sensing, camera-assisted alignment and automated locking mechanisms, the concept aims to improve turnaround efficiency while materially enhancing on-site safety. Reducing driver exposure in busy terminal environments directly supports safer, more automated yard operations and aligns with wider digital port ambitions across the region.

The second concept focuses on integrated driver health monitoring, embedding biometric sensing within the steering mechanism, comparable in principle to heart rate monitoring technologies used in advanced gym equipment. Real-time monitoring of key vitals could provide early health warnings, enabling drivers to safely pull over where necessary and potentially preventing serious incidents. This represents a convergence of transport engineering, human-factor innovation and preventative safety technology.

Both initiatives align strongly with the objectives of the Maritime Last Mile and Net Zero PBIAA initiative (MaLaMi), which supports innovation at the critical interface between port operations and landside logistics, and could also sit appropriately within the Clean Maritime Demonstration Competition Round 7 (CMD7) funding framework, depending on the scope of the funding available. Collectively, these proposals demonstrate how applied advanced technologies can deliver measurable efficiency gains, strengthen safety outcomes and accelerate progress toward lower-emission, digitally enabled maritime logistics systems.

6.22 ASSOCIATED BRITISH PORTS – DIGITALISATION AND EFFICIENCY IN PROCESS

Through the NMI survey, Associated British Ports (ABP) Garston identified 'Port Digitalisation & Infrastructure Innovation' as a key strategic priority. The initiative centres on transitioning toward paperless operational systems, designed to improve efficiency, traceability, and coordination across bulk cargo handling and warehousing allocation. By digitising documentation flows and integrating office-based systems with on-the-ground port operations, the project aims to reduce administrative friction, enhance real-time visibility of cargo movements, and optimise berth, storage, and logistics planning.

This approach reflects a broader shift towards data-enabled port environments, where streamlined digital interaction between operational teams and commercial functions underpins faster turnaround times, improved asset utilisation, and enhanced customer service. As part of the NMI Advanced Technology and Digitalisation theme, this project demonstrates how infrastructure innovation at estate scale can unlock measurable productivity gains while strengthening the region's competitiveness within increasingly data-driven maritime supply chains.



6.3 ADVANCED TECHNOLOGY IN LARGE CORPORATE ENTITIES

6.31 ARMADA TECHNOLOGIES FUTURE HULL DESIGN 'PALS'

Armada Technologies, in conjunction with support from regional partners such as LJMU through the RETROFIT55 project, is developing passive air lubrication systems that reduce vessel hull resistance by creating a controlled layer of air between the hull and surrounding water.

By lowering hydrodynamic drag, the technology delivers measurable reductions in fuel consumption and emissions without altering vessel propulsion systems. Air lubrication directly tackles energy efficiency at the point of greatest impact: hull-water interaction. This makes it an attractive near-term decarbonisation pathway for both newbuilds and retrofit programmes. Armada's approach is particularly relevant to future vessel design. This aligns strongly with the LCR's shipbuilding and advanced manufacturing capabilities, especially for next-generation, low-carbon vessels.

By anchoring passive air lubrication development within the LCR, the region strengthens its position as a centre for net zero vessel design and build, not just port-side decarbonisation. Armada's technology complements shipyard-led innovation, reinforcing the LCR's role in delivering commercially viable, future-ready ships.

6.32 MARLAN MARITIME TECHNOLOGIES

Marlan Maritime Technologies delivers advanced environmental monitoring and sensing solutions for ports and marine infrastructure. As maritime decarbonisation accelerates, environmental scrutiny increases. Marlan de-risks net zero by providing trusted data that enables ports and operators to manage dredging impacts, and support evidence-based decision-making for infrastructure investment.

Marlan's work aligns with advanced technology, holistic resilience, and shore-side port innovation themes highlighted in the NMI dataset as a definitive requirement for the region. This strengthens the LCR's position as a leader in responsible maritime innovation, ensuring that growth, decarbonisation, and environmental protection advance together. This is a critical enabling technology as robust environmental data reduces planning risk, accelerates approvals, and safeguards long-term net zero investments. This could align well with demand in the dataset for feasibility-to-pilot scale projects (£50k-£1m) that unlock larger infrastructure programmes.

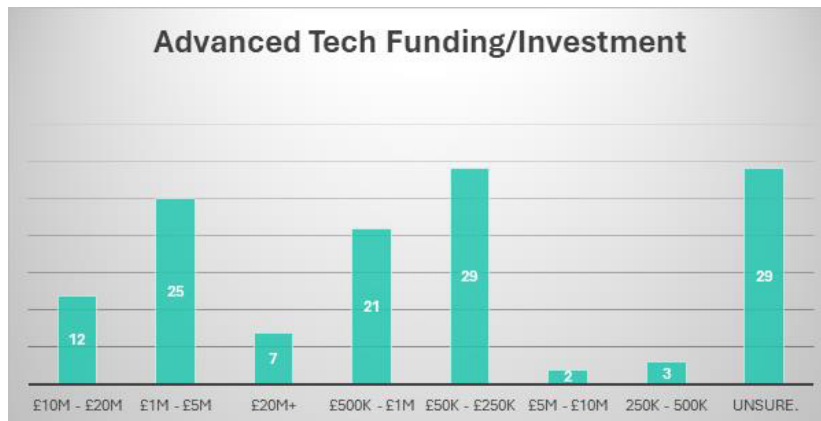


6.4 STRATEGIC CONCLUSION

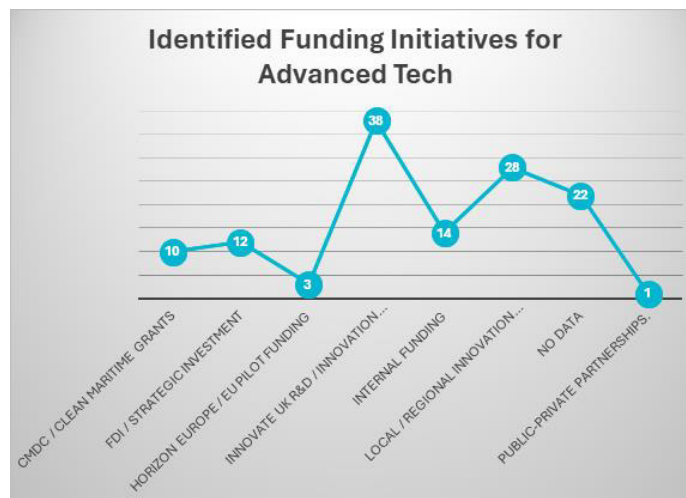
Across corporates, SMEs and Higher Education Institutions, there is clear strategic alignment. Approximately 68% of all projects identified through NMI were advanced technology related. The following data is a breakdown of this theme in more detail.

The NMI dataset evidences a maritime ecosystem in which ~£886m of innovative projects have a primary Advanced Technology focus. Advanced technology within the dataset demonstrate a layered capital ecosystem, characterised by a dense sub-£5m innovation base (55% of AdTech projects), supported by a credible £10m+ infrastructure and 'scale-up' tier, led predominantly by large corporates.

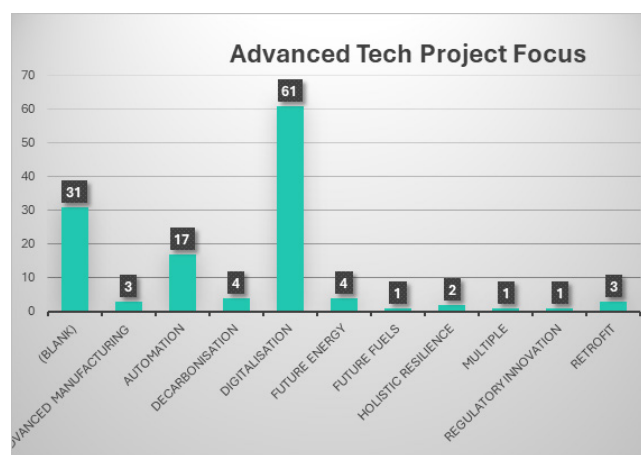
Large corporates dominate projects above £20m and play a central role in the £1m-£5m band. SMEs are concentrated in the sub-£1m bands, reflecting early-stage innovation activity and reliance on regional and national grant instruments. Large corporate contributions account for 70% of all investment in this area within our dataset.



(24%) of all Innovation projects within advanced technologies are targeting Innovate UK R&D / Innovation grants.



Much like the theme of Advanced Technology itself, the findings of the NMI submissions are densely layered and show a mature capital aware maritime ecosystem; one capable of delivering digitalisation, automation and higher order autonomous systems, and energy transition technologies at both regional and national strategic scale.





As part of the Navigating Maritime Innovation programme, we have identified and curated a select group of **"Flagship Spotlight"** innovators operating within the sector. These organisations demonstrate the capability to operate across all NMI thematic areas with both depth and strategic impact.

They represent sector leaders whose work carries significant implications for regional growth and national industrial transformation. Across each thematic pillar, we highlight how these businesses often privately contribute to national targets, accelerating innovation adoption, and strengthening the UK's competitive position in advanced manufacturing, clean energy, and maritime resilience.

7. FLAGSHIP INNOVATORS

APCL CAMMELL LAIRD

INNOVATION IN SHIPBUILDING & MARITIME MANUFACTURING

APCL Cammell Laird is one of the UK's most important sovereign shipbuilding and ship repair assets and a cornerstone of the LCR's maritime economy. With nearly 200 years of shipbuilding heritage, the Birkenhead-based yard combines deep-water access on the Mersey Estuary with heavy-lift capability and one of the UK's largest enclosed construction halls, enabling delivery of complex, high-value vessels.

APCL Cammell Laird projects deploy approximately 50% of their economic impact directly into the LCR. With current trends in the organisation, this has a potential of £1.5bn over the course of the coming years.

The shipyard has delivered nationally significant new-build programmes including the RRS Sir David Attenborough and the new Mersey Ferry and is now primed to transform into an innovative advanced manufacturing hub aligned with UK Defence, offshore energy, and net zero objectives. This transformation centres on the integration of automated shipbuilding, digital production systems, and low-carbon vessel design.

In addition, as the largest ship-repairer in the UK, APCL Cammell Laird is at the forefront of maintaining and upgrading lifeline passenger vessels and military auxiliaries to meet the latest regulatory requirements. A spill over from its focus on new-build technical innovation is the decarbonisation of existing ships through innovative retrofit scopes.

ADVANCED TECHNOLOGY

Investment in a greater level of automation in production and assembly processes will improve productivity, precision and consistency across commercial and public-sector programmes, supported by digital planning and quality systems that reduce, rework and enable scalable delivery.

Alongside this, APCL Cammell Laird is actively developing hybrid, methanol-enabled, vessel designs for current tenders, including service operation vessels and the next-generation of UK public-sector ships. If successful, these projects could position the yard at the forefront of alternative fuel integration and future regulatory compliance.

Innovation in autonomous platforms is also being explored which will span special-purpose civil vessels, automated harbour craft, and defence applications. This will include unmanned naval vessels, aligning with the emerging Ministry of Defence hybrid navy requirement. This work on new-build vessels also underpins the yards' ability to retrofit existing ships with new technology such as clean fuel sources and autonomy solutions.

DECARBONISATION

Decarbonisation of shipyard operations underpins this innovation area for APCL Cammell Laird.

Electrification projects reduce operational emissions, while the UK SHORE CMDC4 shore power installation project enables vessels and yard operations to run on clean electricity instead of diesel generators, representing a leading example of UK maritime decarbonisation. Complementing these practical interventions, APCL Cammell Laird are co-sponsoring a NOMES PhD to develop a carbon lifecycle assessment model with the potential to be translated to shipyards worldwide.

FUTURE ENERGY

In addition to securing funding and progressing the CMDC4 Port Electrification Project, APCL Cammell Laird is exploring further initiatives to enhance energy resilience and operational sustainability.

This includes the potential deployment of large-scale rooftop photovoltaic installations across its estate, supporting greater decoupling from grid dependency and increasing on-site renewable power generation. Such initiatives reflect a broader strategic approach to reducing operational emissions, strengthening energy independence, and positioning the organisation as a leader in sustainable shipbuilding and maritime infrastructure.

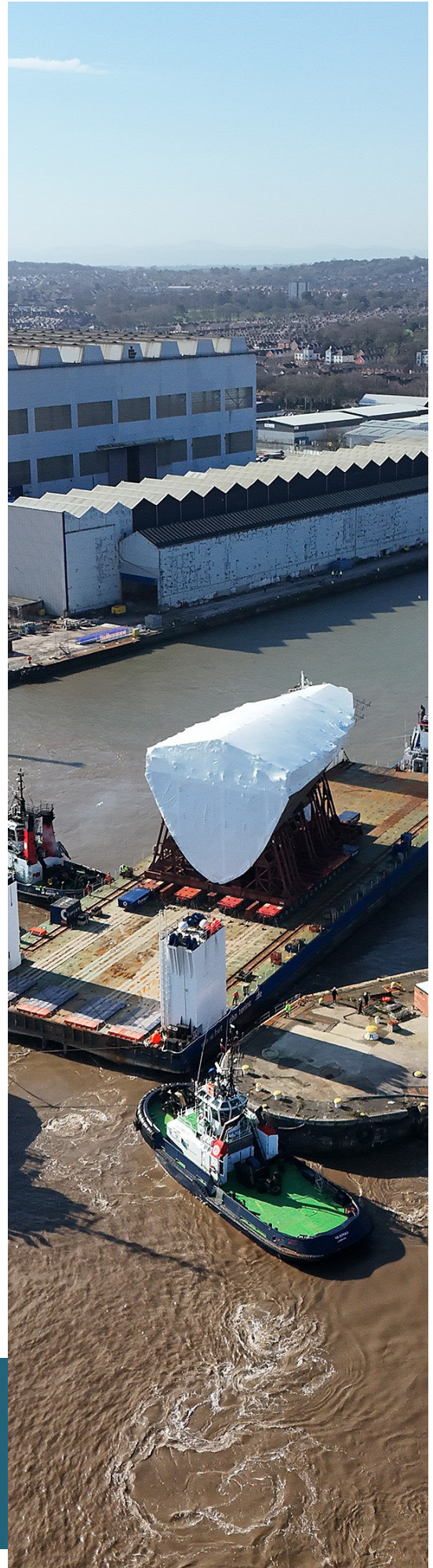
APCL Cammell Laird's modernisation sustains high-value engineering, manufacturing, and digital jobs while strengthening long-term sovereign shipbuilding capability. The shipyard stands as a blueprint for resilient, low-carbon, and globally competitive British maritime manufacturing.

FUTURE CAPABILITY AND STRATEGIC GROWTH AMBITION

APCL Cammell Laird has a clear capacity to expand its advanced manufacturing capability in line with the UK's national shipbuilding and industrial strategies. Greater retention of shipbuilding activity would act as a major catalyst for regional growth in this sense. For example, contract repatriation would unlock enhanced vessel throughput and support investment in modular, automated hull assembly and digitally enriched systems. This evolution would strengthen sovereign maritime capability, improve productivity, and deliver significant regional GVA uplift.

Alongside core shipbuilding expansion, there is further potential to retrofit existing ships with new technology, develop renewable-powered shipyard infrastructure, intelligent port integration, and advanced autonomous marine systems to create a globally competitive hub for next-generation maritime innovation.

APCL Cammell Laird represents approximately **22-25% of the total NMI innovation pipeline**, with the majority of their innovation concentrated in advanced automated shipbuilding, maritime autonomy, defence systems, and low-carbon / future-energy vessel development



8. DECARBONISATION AT SCALE

Decarbonisation is the second most active and capital-intensive area within the NMI dataset, with an estimated £696m in potential and in-flight projects identified.

8.1 SCALE AND COMPOSITION OF ACTIVITY

Large corporate entities account for approximately 92% of total project value in this theme. This reflects the reality that many initiatives relate to:

-  Large-scale infrastructure overhaul
-  Fleet-wide decarbonisation
-  Shore-side electrification
-  Energy system transition

However, the SME community contributes a significant and strategically important portfolio of approximately £19m in innovation-led projects. Crucially, these SME innovations are directly complementary to corporate roadmaps, providing enabling technologies, efficiency gains, and deployable solutions that can be integrated into major infrastructure and fleet programmes.

The NMI dataset therefore can provide a mechanism to:

-  Align future scope
-  Identify complementarities
-  Reduce duplication
-  Accelerate route-to-market
-  Strengthen regional supply chain integration

The data in support of decarbonisation innovations present a unified and functional ecosystem.



8.2 DECARBONISATION IN LARGE CORPORATE ENTITIES

8.21 STANLOW TERMINALS - INDUSTRIAL DECARBONISATION

A central pillar of Stanlow Terminals' transformation is its role in accelerating large-scale industrial decarbonisation across the North West and the wider UK energy system.

Through the development of their New Energies Hub at Stanlow and Tranmere, STL is repurposing existing liquid bulk infrastructure to enable the import, storage, and distribution of low-carbon fuels alongside large-scale CO₂ transportation networks. By supporting sustainable fuels such as renewable methanol, green ammonia, and Sustainable Aviation Fuel (SAF), while facilitating the logistics required for carbon capture and transportation, the hub forms a critical backbone for reducing emissions across aviation, heavy industry, and maritime supply chains.

This infrastructure-led approach demonstrates how legacy energy assets can be re-engineered to support national net-zero targets, positioning the LCR as a key gateway for low-carbon fuel logistics and carbon management systems.



8.3 DECARBONISATION - MICRO AND SME CAPABILITIES

8.31 GT WINGS - WIND-ASSISTED PROPULSION

GT Wings is a LCR based deep-tech and advanced engineering company delivering wind-assist propulsion systems that directly reduce fuel consumption and emissions for commercial vessels. Unlike alternative fuels that require new bunkering infrastructure, vessel retrofits, or uncertain supply chains, GT Wings' solution integrates with existing fleets and fuel systems. They are also working with LJMU to develop a comprehensive training package to support maritime personnel using wind-assisted propulsion technologies.

GT Wings represents a low-risk, high-impact decarbonisation lever: measurable emissions reduction, rapid deployment, and exportable IP in the LCR. For the region, the company strengthens Liverpool's position as a centre for practical maritime net zero delivery.

8.32 CARBON HAPPY WORLD - MARITIME CARBON DATA HUB

Carbon Happy World is developing a Maritime Carbon Data Hub which is a secure, AI-enabled digital platform designed to support the systematic transition of maritime and freeport hinterland logistics toward net zero.

The platform enables centralised integration of otherwise fragmented datasets across freight flows, intermodal connections, terminal operations, customs processes, energy use and asset performance. Through advanced modelling, scenario analysis and emissions analytics, it will enable stakeholders to quantify carbon impacts, test alternative fuel and policy pathways, and identify cost-effective decarbonisation strategies.

By creating an evidence-based decision environment, the Hub strengthens governance, investment planning and operational optimisation across maritime, rail and road interfaces. With planned minimum viable product (MVP) delivery by October 2026 and strong engagement from regional partners including academia, Freeport stakeholders and innovation networks, the project represents a scalable digital infrastructure layer underpinning decarbonisation across the LCR and wider Irish Sea Rim.

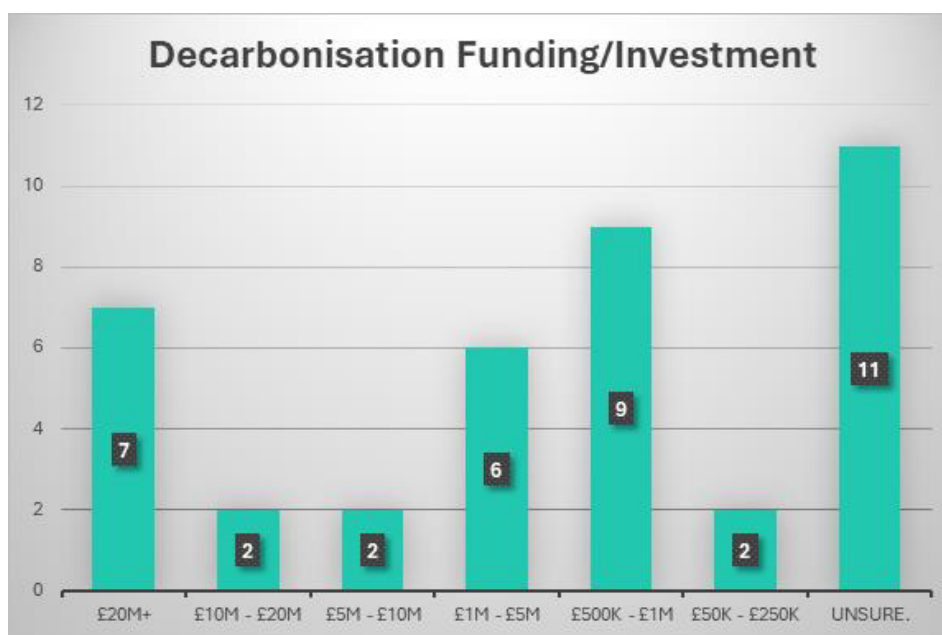


8.4 STRATEGIC CONCLUSION

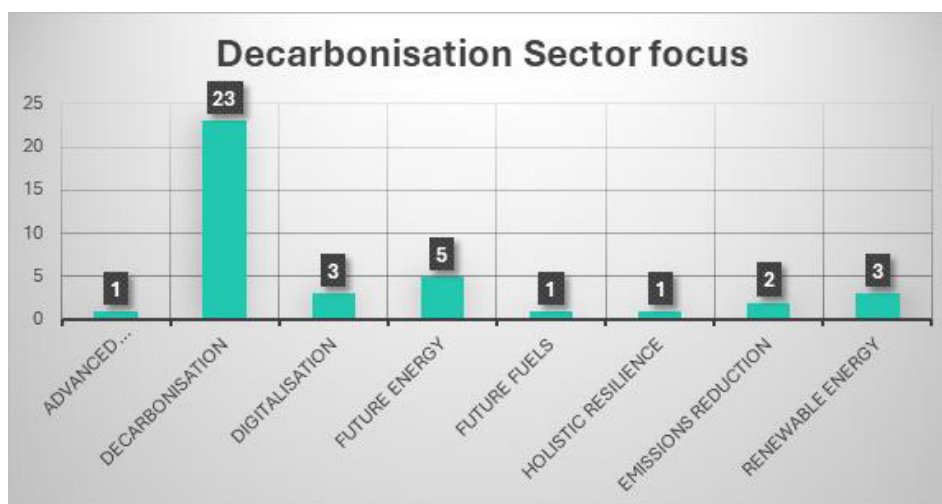
Across corporates, SMEs and Higher Education Institutions, there is clear strategic alignment around decarbonisation as a priority area for maritime innovation. Approximately 21% of all projects identified through NMI sit within this theme, yet they represent a significantly higher proportion of total pipeline value, highlighting the scale and importance of activity in this space. The following data provides a more detailed breakdown of this theme.

The NMI dataset evidences a maritime ecosystem in which nearly £700 million of projects are centred on decarbonisation outcomes. This theme is characterised by a distinctly capital-weighted profile, with a substantial proportion of activity concentrated in higher-value projects, alongside a supporting base of smaller, innovation-led initiatives. This reflects a delivery environment where large-scale transformation programmes are progressing in parallel with the development of enabling technologies.

Large corporates lead the highest-value activity and account for the overwhelming majority of total investment within this theme, demonstrating strong institutional commitment to long-term transition. SMEs are more prevalent in lower-value project bands, contributing targeted innovation and niche solutions that support wider system change. Higher Education Institutions underpin this activity through applied research and technical expertise, particularly in areas such as digital systems, energy integration, and efficiency optimisation.

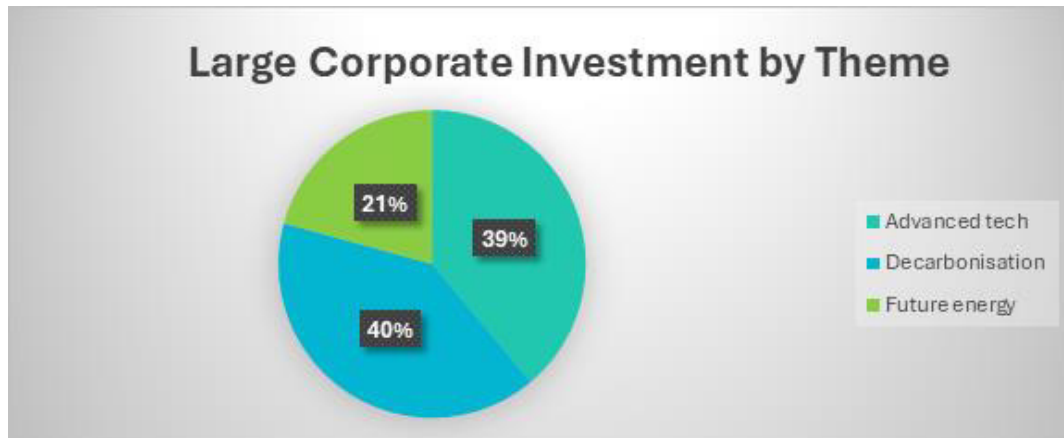


Capital-intensive infrastructure programmes are underway as evidenced with the Stanlow Terminals project. SME innovation pipelines are directly augmenting corporate roadmaps. Academic expertise is embedded in AI/digital applications in decarbonisation, future energy and systems research. This is a layered delivery structure which includes: infrastructure-scale transformation, technology-enabled efficiency gains and future vessel architectures alongside deployable SME innovation reinforced by academic R&D expertise.



The decarbonisation portfolio demonstrates both capital intensity and ecosystem depth. Over 40% of projects exceed £1m in scale, with nearly one-fifth representing £20m+ infrastructure-level investments. Alongside this sits a strong mid-tier innovation layer and a latent early-stage pipeline, indicating both immediate deployment and future growth capacity. It is also worth noting that over a quarter of respondents did not select 'funding' or 'investment allocation', suggesting a need to improve awareness of local and national government funding mechanisms, as well as the scale of investment required to deliver large scale, fleet wide future innovations.

Large corporate organisations account for 92% of the funding and investment opportunity within this theme. Decarbonisation also shows as the largest area of focus for large corporate entities at 40% which indicates an industry that is clearly aware of the requirement to become more proactive in adopting net zero technologies and roadmaps for the future.



In view of these impressive statistics, the LCR maritime sector is actively and demonstrably delivering decarbonisation and net zero. By channelling funding strategically towards innovation-active entities, there is a clear trajectory toward technological advancement, including a rich array of AI/digital enabling capabilities that are already delivering tangible societal benefits. Investment in these projects can stimulate regional employment, strengthen supply chains, attract inward investment, and enhance local authority revenues, mirroring the socio-economic benefits observed in large-scale energy infrastructure projects. A clear example being Stanlow Terminal's NPT Import Terminal project which on its own is estimated to contribute £287 million GVA, support 867 directly employed workers, a further 800-900 contractors, and a wider regional supply chain impact equivalent to over £350 million in procurement and supporting nearly 3,000 additional jobs.





9. FLAGSHIP INNOVATORS BIBBY MARINE

With over 200 years of maritime heritage, Bibby Marine, which is part of the Bibby Line Group, is one of the LCR's most iconic family-owned companies and a cornerstone of the UK's offshore support vessel sector.

Today, that pioneering spirit is embodied in one of the most ambitious clean maritime projects in the world: the Electric Commissioning Service Operation Vessel (eCSOV). Supported by £20m through the UK Department for Transport's 2023 ZEV competition, this transformative project - delivered alongside a consortium of industry leaders including regional partner LJMU - is redefining how next-generation offshore wind vessels are designed, powered, and deployed.

ADVANCED TECHNOLOGIES

Alongside the eCSOV programme, Bibby Marine is progressing an extensive, organisation-wide digitalisation roadmap designed to transform operational efficiency, decision-making, and workforce capability. This includes the development of digital twin systems for commercial operations, real-time financial and executive dashboards to support rapid board-level decision-making, and advanced tools for assessing digital readiness and capability gaps across roles and future workforce requirements. Operational resilience is being strengthened through digital spare parts inventory management for over 330,000 components annually, paperless systems, and automation of routine HR processes.

Central to this transformation is Bibby Marine's Unified Name Space (UNS) programme, which is acting as a digital backbone for the organisation. Through UNS, operational, technical, environmental, and commercial data streams are being digitised and integrated into a centralised architecture, enabling high levels of cross-system visibility and interoperability. The eCSOV vessel is being used as a live testbed for many of these capabilities, including data stabilisation for fuel burn optimisation, environmental and battery performance feedback, and situational system stress analysis. Collectively, this approach positions Bibby Marine to deliver step-change efficiency gains while establishing a scalable digital model for future low-carbon and autonomous-ready maritime operations.

DECARBONISATION

Bibby Marine has indicated a forward-looking strategic interest in the development of dedicated carbon transport vessels to support the emerging carbon capture, utilisation, and storage (CCUS) economy.

As industrial-scale carbon sequestration and offshore storage infrastructure expands, specialised vessels will be essential for the safe, efficient, and flexible transport of captured CO₂ from industrial hubs to offshore injection or storage sites. These assets would play a critical role in interlinking onshore capture facilities with offshore pipeline networks and sequestration reservoirs, forming a key logistical component of the wider carbon value chain. By aligning vessel design with future pipeline infrastructure, Bibby Marine's potential contribution would support system-wide decarbonisation, enabling regional industry to participate directly in large-scale carbon reduction and storage pathways.

FUTURE ENERGY

Bibby Marine is advancing a range of innovative future-energy concepts focused on alternative propulsion, energy recovery, and next-generation vessel architectures. One significant development trajectory includes exploration of waste-heat recovery and circular energy systems, including research into a human effluent-to-energy waste recovery vessel concept.

Such systems aim to dramatically reduce environmental impact by capturing and converting onboard waste streams into usable energy, contributing to closed-loop operational models and reducing reliance on fossil-derived power sources.

As we have already heard, the heart of Bibby Marine's innovation trajectory is the development of the world's first fully eCSOV. The vessel is engineered around a 20MWh battery system, one of the largest maritime battery installations proposed globally, supported by dual-fuel methanol engines as a clean-energy redundancy system. The eCSOV is a platform that sets a global benchmark for the decarbonisation of the offshore wind service fleet.

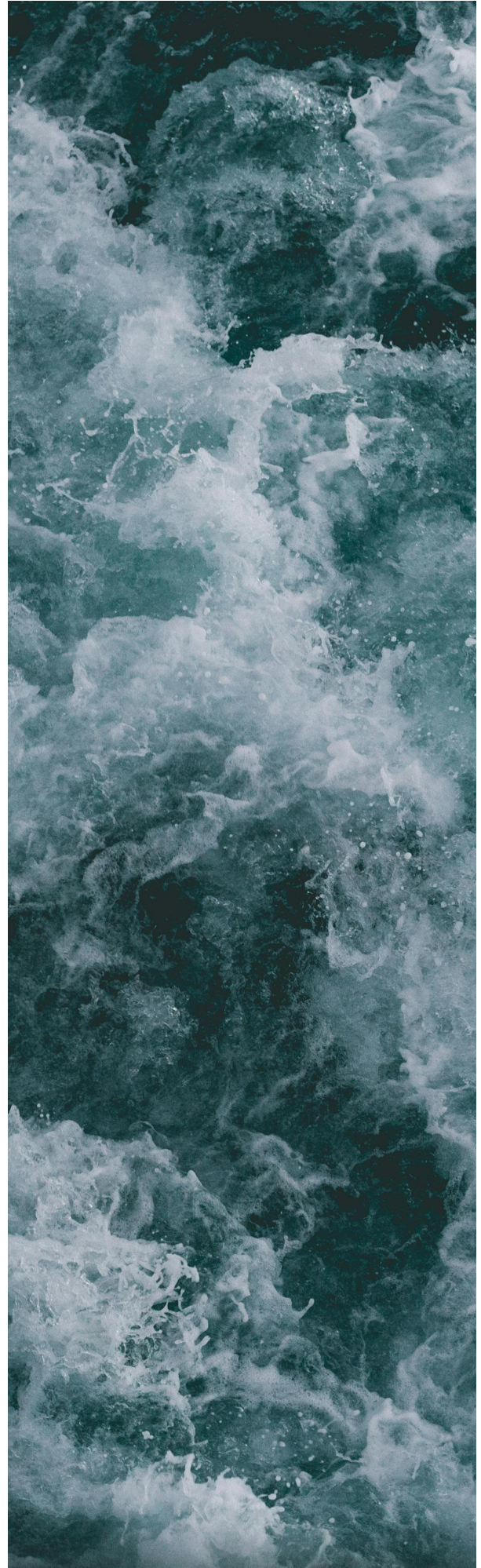
A flagship for the future of Innovation:

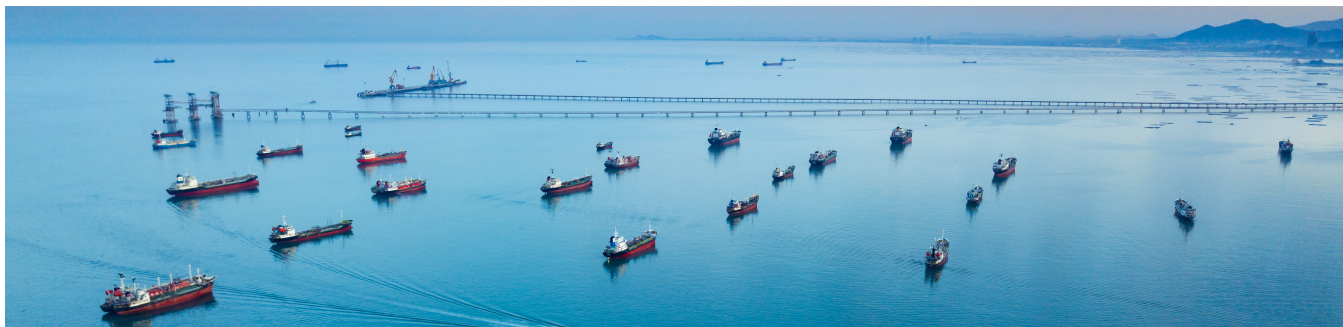
"Bibby Marine's eCSOV project demonstrates our agile approach to vessel innovation within the emerging offshore electric service vessel sector and represents a genuine step change for industry. Beyond the vessel itself, the eCSOV also serves as a launchpad for Bibby Marine's extensive digital innovation roadmap enabling demonstration of cutting edge connected intelligent systems. This mission is driven by Bibby's ethos and long-standing commitment to innovation and technical excellence and represents a substantial commitment of private investment into innovative technology."

- NIGEL QUINN CEO OF BIBBY MARINE

In alignment with the findings of the NMI project, Bibby Marine is shaping the future of offshore wind support vessels as well as helping define the LCR as a global hub for clean maritime excellence.

Bibby Marine represents approximately 18 - 21% of the total NMI innovation pipeline, with the majority of their innovation concentrated in advanced digital systems and future proof smart connected capabilities as well as future-energy vessel development.





10. FUTURE ENERGY AT SCALE

Future energy was the third most thematically impactful area of focus within the NMI dataset, with an estimated £342m in potential and in-flight projects.

10.1 SCALE AND COMPOSITION OF ACTIVITY

Large corporate entities account for approximately 96% of total project value in this theme. This reflects:

- Large-scale infrastructure overhaul requirements
- Vessel-wide propulsion system conversions
- Fuel storage, bunkering and handling infrastructure
- The balance sheet strength required to undertake fuel transition risk

It is worth noting that 35% of identified projects within this theme (7 of 20 responses) are currently without a confirmed funding allocation ("unsure" was selected in response to the question posed). This likely reflects the capital complexity and transitional uncertainty associated with future fuel system implementation, where infrastructure compatibility, fuel availability, regulatory alignment, and rapid technological evolution make cost forecasting and funding pathways more dynamic than in conventional innovation themes. Many of these unallocated projects could drastically increase the 'pot' within this particular theme.

10.2 FUTURE ENERGY IN LARGE CORPORATE ENTITIES

10.21 GLOBAL SHIPPING LINES

Major operators with a strong footprint in the Liverpool City Region are advancing transitional fuel strategies across their fleets. Stena Line continues to invest in efficiency upgrades, hybridisation, battery integration and alternative fuel readiness across its RoRo and ferry services, including routes operating through the Irish Sea corridor.

Meanwhile, Maersk, although headquartered in Copenhagen, maintains significant regional activity and is progressing large-scale deployment of methanol-capable container vessels as part of its decarbonisation roadmap. Notably, Maersk was the single largest contributor to the NMI Future Energy survey dataset, underscoring both the scale of its regional engagement and its strategic interest in collaborative transition pathways. Collectively, these operators reinforce that future-fuel innovation within the region is not confined to isolated pilots but is being driven by globally significant shipping lines aligning fleet renewal, retrofit programmes and port interface requirements with emerging low-carbon fuel ecosystems.

10.22 STENA LINE: HYBRID PROPULSION, WIND-ASSIST AND ALTERNATIVE FUEL READINESS

Stena Line's recent investments demonstrate a practical, commercially deployed approach to decarbonisation. The company has introduced next-generation "New Max" RoRo vessels; Stena Futura and Stena Connecta, on the Belfast-Heysham corridor, increasing freight capacity while integrating hybrid propulsion systems capable of operating on battery power, biofuels and methanol.

A standout feature is the installation of Norsepower Rotor Sails, with two 28×4m units fitted to Stena Connecta. These wind-assisted propulsion systems can deliver up to 9% fuel savings, directly reducing emissions and improving operational efficiency. The vessels entered service in late 2025 and early 2026 and have undertaken berth fittings at 12 Quays, Birkenhead, demonstrating operational relevance to the Liverpool City Region.

The company's openness to collaboration with technology providers, HEIs and RTOs further strengthens the region's innovation ecosystem.

10.23 MAERSK: METHANOL-POWERED SHIPPING

Global shipping leader A.P. Moller - Maersk is pioneering the use of green methanol as a low carbon marine fuel, marking a major step forward in the decarbonisation of global shipping. In 2023, the company launched Laura Maersk - the world's first container vessel capable of operating on green methanol.

Equipped with a dual fuel engine, the vessel can run on either conventional marine fuel or green methanol produced from renewable sources. This enables immediate emissions reductions while alternative fuel supply chains continue to scale, with methanol acting as a transitional fuel on the pathway towards net-zero shipping.

Building on this milestone, Maersk has since ordered a new generation of larger methanol-enabled container ships to operate on major international trade routes. The programme forms part of the company's ambition to achieve net-zero greenhouse-gas emissions by 2040, demonstrating how investment in alternative fuels and propulsion technologies is accelerating the maritime sector's transition to a more sustainable future.

10.3 FUTURE ENERGY – MICRO AND SME CAPABILITIES

10.31 GRAFMARINE, RENEWABLE ENERGY RESILIENCE OF THE FUTURE

Grafmarine is developing advanced photovoltaic surface technology designed specifically for maritime environments. This solution is engineered to integrate directly into vessel decks and working surfaces, enabling ships to generate renewable power without sacrificing operational space or safety and distributing onboard energy generation, reducing reliance on main engines, auxiliary generators, and shore power for low-to-medium electrical loads. While not intended to replace primary propulsion energy, the system meaningfully contributes to powering navigation systems, sensors, auxiliary equipment, and future electrified subsystems.

This directly addresses one of the key risks identified in the Navigating Maritime Innovation dataset: energy resilience during transition. This innovation could support localised shore-side electrification in the near future too with the right scale-up, powering dockside systems, sensors, charging points, lighting, and auxiliary vessel connections. While not grid-scale generation currently, this form of distributed renewables reduces peak demand, improves resilience, and lowers operational emissions.

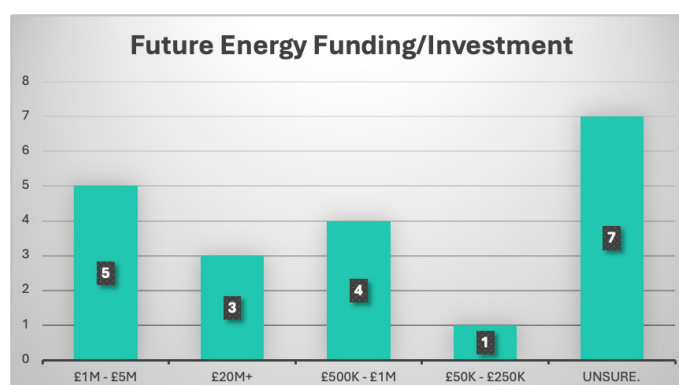
This aligns closely with the LCR's growing focus on port electrification, energy optimisation, and hybrid energy systems. Embedding Grafmarine within the LCR innovation ecosystem would strengthen regional capability in future energy resilience, maritime renewables, and integrated vessel / port energy systems.

10.4 STRATEGIC CONCLUSION

Although corporate-led in value terms (96%), Higher Education Institution (HEI) involvement remains strategically important in the Future Energy theme. HEIs represent 20% of funding-route responses and contribute an estimated innovation portfolio of approximately £12m. This provides a fundamental lifeline for SMEs in navigating the 'valley of death', ensuring early stage concepts can progress toward commercial readiness. This stabilising effect is amplified through co-funded innovation pathways, particularly those enabled by HEI partnerships and UKRI funding mechanisms, directly complementary to corporate fuel transition roadmaps and regional hub-and-spoke future energy models.

This demonstrates a portfolio characterised by major infrastructure anchors, supported by a meaningful mid-tier deployment layer. The NMI dataset on future energy provides a mechanism to identify infrastructure-ready vessel and port conversion opportunities, align HEI research capability with near-term corporate retrofit programmes and de-risk funding pathways through clearer mapping of available instruments.

This is an emerging sector of innovation, and with the help of NMI data, the directionality and industry-led approach will refine and define where funding ought to be deployed for maximum system impact.



The future energy portfolio demonstrates both capital intensity and ecosystem depth. This indicates immediate infrastructure-scale transition capability, supported by a structured innovation layer. Across corporates, SMEs and HEIs, the data demonstrates that:

- Future energy opportunities are predominantly capital-intensive and infrastructure-led (96% corporate value share)
- A meaningful mid-tier innovation band exists, with 69% of value-declared projects between £500k–£5m, representing scalable deployment activity
- HEIs account for 20% of funding-route responses, acting as research accelerators aligned to corporate roadmaps
- 35% of projects have no declared funding route, indicating advisory and coordination opportunities

This creates a strategic roadmap for future energy implementation:

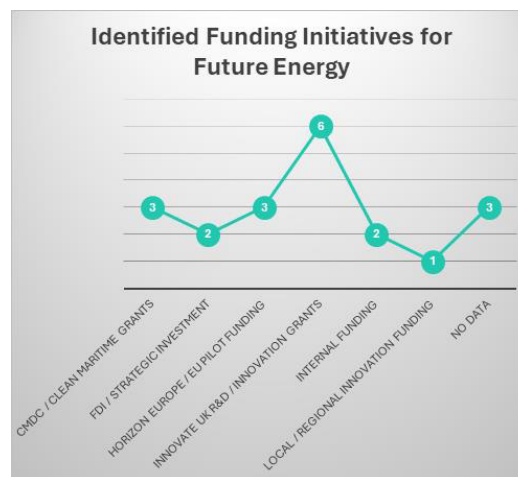
- Anchor large-scale retrofit and infrastructure projects (£20m+)
- Strengthen the £1m–£5m commercial deployment layer
- Align HEI research with corporate conversion timelines
- Provide structured funding-navigation support to reduce "unsure" responses

The result is a region where future energy systems are:

- Embedded across vessel and port environments
- Supported by integrated research and innovation pathways
- Structured across clear capital tiers
- Positioned for inward investment and infrastructure-scale deployment

The NMI dataset evidences a maritime ecosystem in which:

£342m of innovative projects have a primary Future Energy focus. This innovation layer is strengthened further by dedicated regional programmes such as the NOMES CDT (Centre for Doctoral Training in Net Zero Maritime Energy Solutions), jointly delivered by the University of Liverpool and Liverpool John Moores University, providing a structured talent and research pipeline focused on net zero maritime energy. However, it is also observed that many projects identified in the NMI data set are currently without an allocated funding or investment amount and therefore this theme's economic impact could be substantially higher if known.



30% of funding-route responses target Innovate UK R&D / innovation grants. While large corporates make up 55% of the entries to this theme, 35% of responses including many potentially large-scale future fuel vessel refit programmes, did not enter funding data. This highlights an education and advisory opportunity for funding pathway optimisation.

It is possible to conclude from the NMI Future Energy dataset that the Liverpool City Region is in a transitional, pre implementation phase. The presence of £20m+ retrofit signals, structured mid-tier deployment activity and appetite strong Innovate UK engagement, and HEI–corporate alignment demonstrates a region capable of delivering transitional marine fuel systems at scale in the near future.

With clearer funding navigation and strategic coordination, the LCR is positioned to act as a demonstrator cluster for vessel conversion, alternative fuels, and integrated maritime energy systems within the UK maritime decarbonisation landscape.

11. FLAGSHIP INNOVATORS

STANLOW TERMINALS

Stanlow Terminals (STL), the UK's largest independent bulk liquid storage provider, is central to the national energy supply chain and fuel resilience. As the UK moves towards net zero, STL is driving energy infrastructure transformation and large-scale industrial decarbonisation.

Through its strategic location, advanced logistics, and investment in new technologies, STL is positioning the Liverpool City Region as a clean energy hub, with its New Energies Hub enabling low-carbon fuels, carbon capture, and next-generation energy systems.

DECARBONISATION

At the core of Stanlow Terminals (STL)'s innovation programme is a transformative commitment to large-scale decarbonisation through the development of its 'New Energies Hub'. This initiative is designed to enable the capture, import, storage, and distribution of low-carbon fuels and CO₂ at industrial scale across Stanlow and Tranmere. With planned capacity of 1-6 million tonnes per year of CO₂ import, STL is establishing critical infrastructure for carbon capture, utilisation and storage (CCUS), supporting both regional industry and national net zero objectives.

Through the integration of CO₂ logistics with existing terminal capabilities, STL is enabling a fully connected decarbonisation ecosystem. Its infrastructure - comprising extensive pipeline networks, deep-water jetties, and high-capacity storage - allows for efficient routing and handling of carbon flows across the UK. This positions STL not only as a regional enabler, but as a nationally significant platform for industrial emissions reduction and carbon management.

ADVANCED TECHNOLOGY

STL's transformation is underpinned by the deployment of advanced terminal technologies and highly integrated logistics systems, creating one of Europe's most sophisticated liquid bulk operations. The terminal network includes two deep-water jetties at Tranmere, six vessel berths at Stanlow, 248 storage tanks with over 3 million cubic metres of capacity, and Europe's largest self-loading road gantry.

These physical assets are complemented by increasingly digitalised terminal systems and multi-fuel handling capabilities, enabling flexible, high-throughput operations across a diverse range of energy vectors. The ability to manage complex blending, storage, and distribution processes for emerging fuels demonstrates STL's role at the forefront of infrastructure-led innovation. Within the NMI programme, this convergence of digital systems, logistics optimisation, and engineering excellence highlights the region's growing strength in advanced industrial technologies.

FUTURE ENERGY

The New Energies Hub represents a cornerstone of the UK's future energy system, designed to handle a wide spectrum of next-generation fuels. STL is developing capacity for a North West hub for Sustainable Aviation Fuel (SAF), including import, storage, blending, and distribution, alongside up to 1 million tonnes of renewable methanol and ambitions for 2 million tonnes of green ammonia throughput. The site also supports the development of low-carbon hydrogen distribution via road, with future potential for ammonia-to-hydrogen conversion.

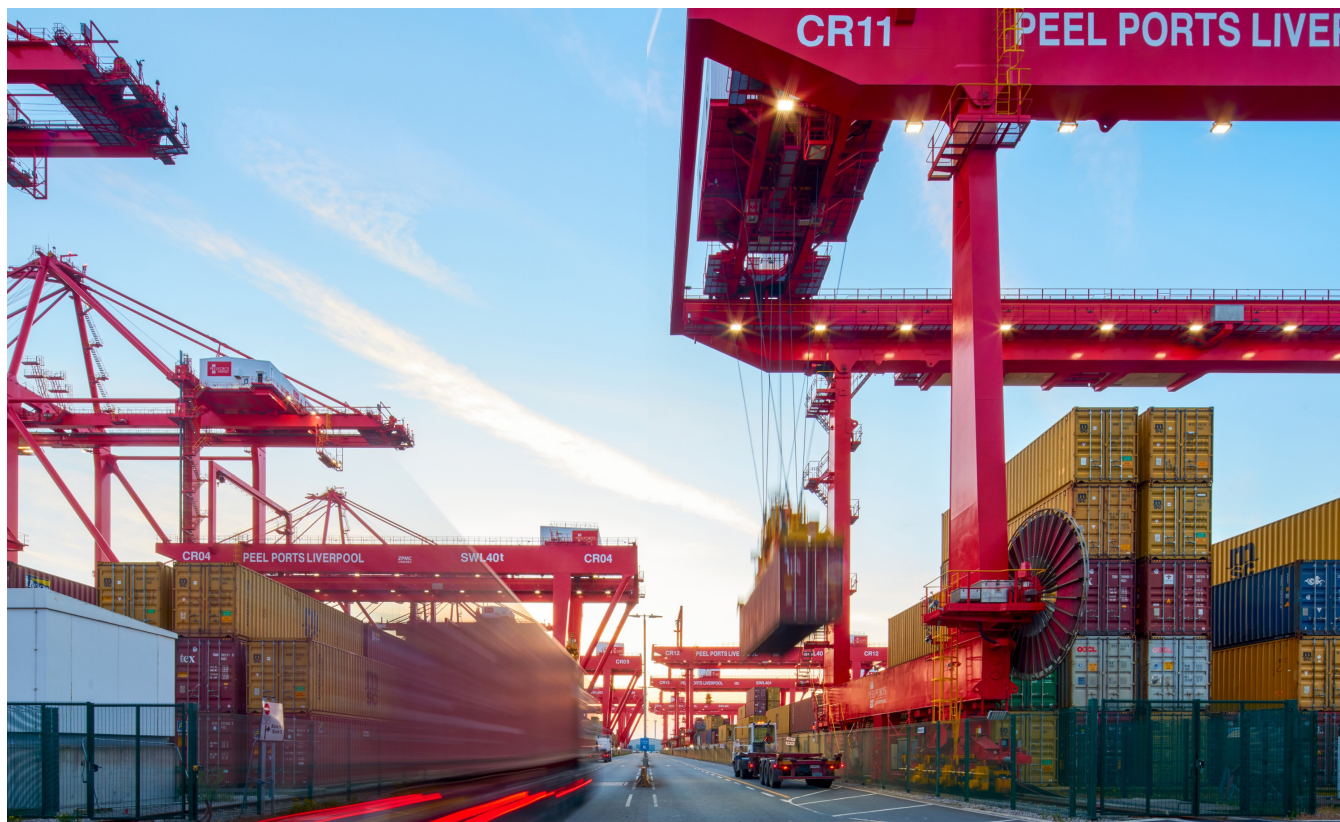
This ambitious programme is being delivered in collaboration with key partners including the Department for Energy Security and Net Zero, the Department for Transport, Essar Energy Transition, and EET Hydrogen, alongside specialist CCUS and engineering organisations. Together, they are enabling a phased, scalable system for low-carbon fuel imports, CO₂ transport, and hydrogen production and distribution.

"As the LCR strengthens its ambition to become a national leader in clean energy logistics and low-carbon maritime systems, Stanlow Terminals stands as a pivotal example of how regional industrial heritage can be transformed into world-leading energy transition infrastructure. The New Energies Hub represents not just a terminal of the future, but the foundation of an integrated, resilient, and low-carbon energy system for the UK."

- **MIKE GAYNON, CEO - STANLOW TERMINALS LTD**

Stanlow Terminals represents approximately **26 - 29%** of the total NMI innovation pipeline. Their work in advancing the energy resilience of the LCR is clearly a nationally significant infrastructural first.





12. FLAGSHIP INNOVATORS

PEEL PORTS GROUP

Peel Ports Group is one of the UK's largest port operators, overseeing a national network of strategic ports and terminals that play a critical role in the movement of goods, energy, and materials across the UK supply chain. As a long term investor in critical UK maritime assets, Peel Ports combines operational expertise with largescale infrastructure development, digital transformation, and decarbonisation programmes to strengthen the resilience, competitiveness, and sustainability of the nation's port ecosystem.

ADVANCED TECHNOLOGY

Peel Ports is embedding advanced digital and automation technologies across its estate to enhance operational safety, efficiency, and systems integration. The deployment of the HALO digital safety system, automated gate operations, and the transition to paperless, data-driven processes are reducing risk and improving throughput while establishing the foundations of a fully integrated smart port environment.

Investment in private 5G networks, the Tech365 digital platform, interconnected SCADA (Supervisory Control And Data Analytics) systems, and digital twin capability enables real-time asset monitoring, predictive maintenance, and scenario-based operational planning. These technologies enhance automation readiness across terminals, marine services, and energy infrastructure, strengthening resilience and decision-making.

Looking forward, Peel Ports is exploring autonomous and semi-autonomous tugs, automated barges, intelligent mooring systems, and next-generation port-vessel interfaces, positioning the Port of Liverpool as a demonstrator site for advanced maritime systems integration.

DECARBONISATION

Infrastructure-led decarbonisation is central to Peel Ports' strategy. Estate-wide consolidation and digitisation of operational systems are delivering measurable efficiency gains by reducing vessel holding times, optimising asset utilisation, and lowering Scope 1 and Scope 2 emissions. The integration of smart technologies ensures that digital innovation directly supports carbon reduction outcomes.

Shore-side decarbonisation programmes include large-scale renewable deployment, HVO fuel transition across port plant, and the electrification of marine interfaces. These initiatives materially reduce operational emissions while enhancing long-term energy resilience across the estate.

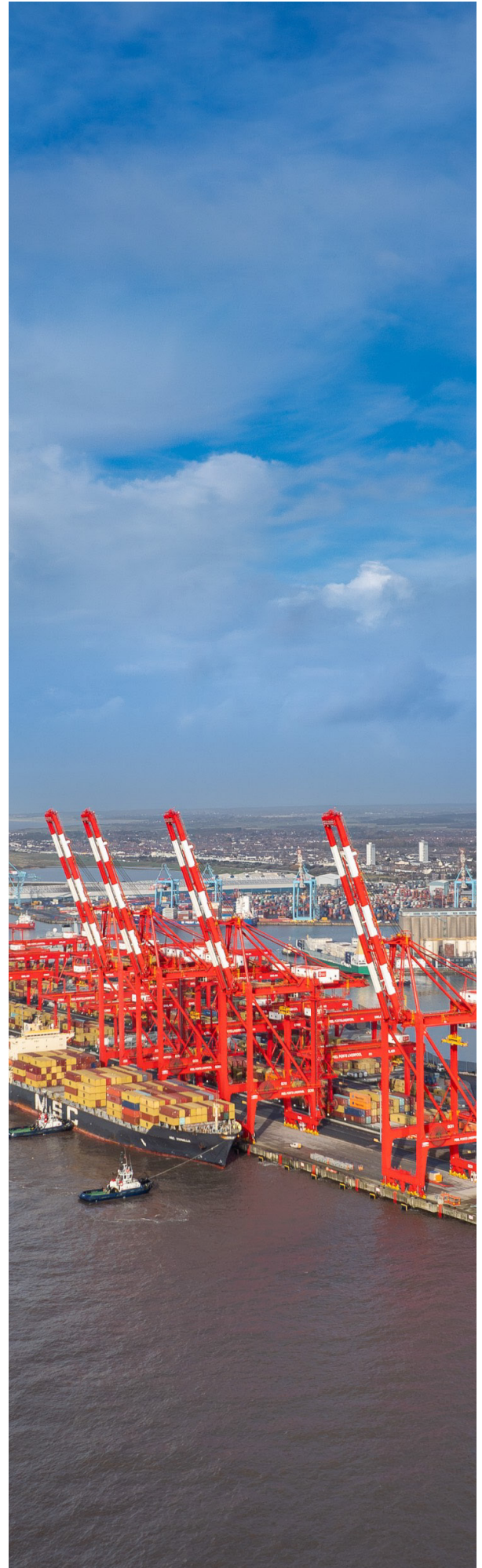
FUTURE ENERGY

Peel Ports is advancing significant renewable generation capacity, including up to 31MW of solar installations and wind repowering, alongside hydroelectric generation. Delivered in partnership with E.ON, the photovoltaic programme represents one of the largest renewable energy rollouts across a UK port estate, contributing to ambitions for on-site renewable self-sufficiency.

In parallel, Peel Ports is exploring electric ship charging, shore power infrastructure, green shipping corridors, and future fuel bunkering solutions. These initiatives position the Port of Liverpool as a testbed for low-carbon fuels and next-generation propulsion integration within the wider maritime cluster.

Through collaboration with universities, technology providers, and public-sector partners, Peel Ports demonstrates how advanced technologies, renewable energy deployment, and future-fuel readiness can converge at estate scale to support regional growth and national net zero delivery.

Peel Ports group represents approximately **8-8.5%** of the total NMI innovation pipeline. Its core innovation focus spans digitalisation and automation of port operations, decarbonisation through on-site renewable energy and clean fuels infrastructure, advanced safety systems, and future maritime logistics capabilities - **positioning the Port of Liverpool as a nationally significant testbed for smart, low-carbon maritime infrastructure.**



13. STRATEGIC POSITIONING

LCR STRENGTHS

13.1 LIVERPOOL JOHN MOORES UNIVERSITY (LJMU)

Liverpool John Moores University (LJMU) is one of the UK's most strategically important academic institutions for maritime innovation. With roots dating back to 1892 as England's first Nautical College, LJMU is one of only five UK universities specialised in maritime education. Underpinning this educational excellence, its maritime-related post-graduate teaching programmes are fully accredited by leading professional bodies, including the Institution of Engineering and Technology (IET), the Institution of Mechanical Engineers (IMechE), and the Chartered Institute of Logistics and Transport (CILT). Today, it plays a central role in de-risking net zero, digitalisation, and autonomy across the LCR's maritime economy.

At the core of this capability is the Liverpool Logistics Offshore and Marine Research Institute (LOOM), a nationally significant facility holding over £15m in external funding. LOOM delivers analytical and AI-based modelling, underpinning evidence-based decision-making for ports, vessel operators, and offshore developers. According to the latest Research Excellence Framework (REF2021, UoA12), LOOM research in maritime/engineering was ranked the best in the North West (96% world-leading or international excellence) in terms of research output quality. In the same assessment, LOOM research impact was rated 100% world-leading or international excellent – equal first in the UK. According to 2025 Global Ranking of Academic Subject by Shanghai Ranking, its research impact is ranked first globally. The institute is holding an ERC grant of €1.99M – one of Europe's most prestigious research grants. Alongside LOOM is the unique LJMU Maritime Centre, featuring a £5m advanced maritime simulation suite which includes recently upgraded 360-degree ship bridge simulators through a £650,000 Office for Students (OfS) grant. The Maritime Centre provides its training and consultancy services to APCL Cammell Laird for simulations of the new Mersey Ferry and to Stena Line for their eFlexer class vessels.

A significant recent development within this ecosystem is the establishment of the Global Centre for Maritime Innovation (GCMI) at LJMU in November 2024. The Centre consolidates LJMU's internationally recognised capabilities into a single global-facing platform designed to accelerate sustainable maritime transformation. Priority areas include the decarbonisation of global shipping, workforce development for autonomous vessels, maritime safety, and equitable governance of ocean resources.

This technical capability is reinforced by major national programmes. The Maritime and Last Mile Place-Based Impact Accelerator Account (MaLaMi) is a £2.67m programme led by LJMU (in partnership with the University of Liverpool, Mersey Maritime, the LCR Combined Authority and others), which positions the region as a testbed for real-world maritime innovation and delivers 77 industry-led projects backed by £8m. This is complemented by the £8.5m Net Zero Maritime.

Solutions (NOMES) Centre for Doctoral Training, co-led by the University of Liverpool and LJMU with 30 industry partners, which trains researchers to tackle emerging net-zero maritime challenges.

LJMU is driving critical advancements in port digitalisation and decarbonisation through extensive, high-value industry collaborations. The university co-leads a £4.3m EPSRC-funded project to develop a national digital twin for port-centric systems, in collaboration with Mersey Maritime, Sefton Council, Peel Ports and LCR Freeport/CA. This digital infrastructure is reinforced by regional sensor networks from an £18m ERDF part-funded initiative and a £250,000 Freeport Freight Corridor Insights project. Additionally, LJMU is optimising vessel technologies through the €5.7m RETROFIT55 project. They are also partnering with Bibby Marine on a £20m Innovate UK project to build digital twins for shore power facilities. Furthermore, an £800,000 Freeport Thematic Doctoral Pathways project utilises AI to pioneer smart port security and environmental impact analysis. Together with partners like Peel Ports and LCR Freeport, these strategic investments are delivering tangible, clean maritime solutions.

LJMU has extensive expertise in translating research into real-world applications. Its impactful research has played a pivotal role in generating multi-million-pound revenues for partners (e.g., \$110m p.a. for Shell) and demonstrating significant reductions in container handling costs (23%) and emissions (19%) for global ports. Locally, LJMU provides direct commercial consultancies, verifying designs for the Liverpool 2 terminal, modelling navigation for the Royal Seaforth dock, Belfast and Dublin harbours, Mersey Ferries and Liverpool Cruise terminals, and delivering bespoke training via the Maritime Centre for clients like Stena Line, Brookes Bell and many others.

LOOM has coordinated five EU-funded projects (i.e., REFERENCE, ENRICH, REMESH, RESET and FAVOR) and participated in a further twelve (e.g., INTRADE, WEATFLOWS, ARCWIND and RETROFIT55) under the European Commission's framework programmes. These projects have strengthened international collaboration in maritime safety, logistics resilience, emergency response systems, digitalisation and decarbonisation. In addition, LOOM has organised and delivered the UK's annual Mastering Shipbuilding Management course since 2024, engaging professionals from across the maritime sector in the UK and internationally.

Through these world-class facilities, extensive data networks, and deep industrial partnerships, LJMU provides the skills, modelling, and systems integration that enable the LCR to move from maritime innovation to large-scale, investable deployment, firmly establishing the region as a global maritime powerhouse.

13.2 UNIVERSITY OF LIVERPOOL

The University of Liverpool (UoL) stands as a central pillar in the LCR's maritime innovation ecosystem, delivering world-leading capability across net zero energy, digitalisation, and systems integration. With deep-rooted maritime heritage and a forward-facing research agenda, UoL plays a critical role in translating fundamental science into industry-led solutions that address the most pressing challenges in the maritime sector.

At the forefront of this capability is the Net Zero Maritime Energy Solutions (NOMES) Centre for Doctoral Training. A programme led by UoL in collaboration with LJMU, representing an £8.5 million investment through the Engineering and Physical Sciences Research Council (EPSRC) and regional industry partners, NOMES is an eight-year programme currently supported by 38 organisations across the maritime energy ecosystem. Crucially, the programme is not limited to academic research translation; it is explicitly designed to progress industry-led innovation in net zero maritime energy, aligning doctoral research directly with real-world deployment challenges. Alongside its technical focus, NOMES is equally committed to developing future leaders in the maritime energy sector, embedding skills, leadership, and systems thinking into the next generation of researchers and practitioners.

This strategic positioning is further strengthened by UoL's involvement in national clean energy initiatives. Supported by Peel Ports, the University is a member of the UK National Clean Maritime Research Hub, reinforcing Liverpool's ambition to become a flagship centre for clean maritime innovation. In parallel, UoL contributes to fundamental research through its participation in the EPSRC Centre for Doctoral Training in Skills and Training Underpinning a Renaissance in Nuclear (SATURN), enabling cross-sector knowledge transfer between nuclear energy and maritime decarbonisation, particularly in areas such as alternative fuels, energy systems integration, and long-term infrastructure resilience.

Digitalisation and advanced systems capability are core strengths of the University's offer. The Centre for Doctoral Training in Distributed Algorithms, delivered in collaboration with STFC Hartree, IBM Research, The Alan Turing Institute, and over 20 project partners, provides cutting-edge expertise in distributed systems, optimisation, and data-driven decision-making. These capabilities are directly applicable to maritime challenges including port optimisation, autonomous systems, logistics coordination, and real-time operational intelligence.

These programmes are underpinned by UoL's Digital Innovation Facility (DIF), a flagship platform for large-scale simulation, real-time monitoring, and digital twin development. The DIF integrates diverse datasets, including maritime activity, energy systems, transport flows, and environmental indicators, into a high-resolution digital representation of the Liverpool City Region. For the maritime sector, this enables advanced modelling of vessel movements, berth utilisation, port congestion, and the interaction between port operations and landside logistics. The result is a powerful decision-support environment that enhances efficiency, resilience, and long-term planning across the maritime value chain.

UoL also provides national leadership in coastal resilience and climate adaptation. As part of the COAST-R Network, supported by UKRI and DEFRA within the wider Resilient Coastal Communities and Seas programme, the University contributes critical research on climate risk, coastal systems, and community resilience. This work is directly relevant to ports and maritime infrastructure, supporting evidence-based approaches to adaptation and long-term sustainability.

The Operations and Supply Chain Management research group within University Of Liverpool Management School have a well-established track record in the novel use of data and modelling for supply chain optimisation across maritime and multi-model transport logistics.

Collectively, the University of Liverpool delivers an integrated model of skills development, fundamental research, and applied innovation, spanning energy, digital systems, and environmental resilience. Its ability to align doctoral training with industry need, supported by national-scale infrastructure and partnerships, positions it as a key enabler of the Liverpool City Region's transition from maritime innovation to large-scale, investable deployment in a net zero future.



13.3 NATIONAL OCEANOGRAPHY CENTRE (NOC)

OCEAN SCIENCE, DATA & AUTONOMOUS MARITIME SYSTEMS

The National Oceanography Centre (NOC) is one of the UK's most strategically important maritime research institutions and a global leader in ocean science, data stewardship, and autonomous marine systems. With major hubs in Southampton and Liverpool, NOC represents a critical national asset whose capabilities directly support marine policy, infrastructure planning, environmental protection, and maritime innovation.

At the core of NOC's impact is its stewardship of pivotal national and international ocean datasets, providing the evidence base for decision-making across offshore energy, coastal protection, port development, and marine spatial planning. These include the British Oceanographic Data Centre (BODC), the Permanent Service for Mean Sea Level (PSMSL) and the National Tide and Sea Level Facility (NTSLF), which is the world's authoritative global tide-gauge dataset, NOC also connects into national capabilities like BOSCORG, the UK's national marine sediment archive. Together, these long-term datasets inform assessments of sea-level rise, seabed stability, dredging impacts, coastal erosion, and multi-hazard environmental risk.

Through its commercialisation arm, NOC Innovations, the organisation bridges science and industry by making their world-class expertise, independent data and cutting-edge technology available to help organisations tackle complex maritime challenges.

Innovations include deep-sea eDNA biodiversity sampling, lab-on-a-chip water quality diagnostics, high-resolution seabed and intertidal mapping, autonomous underwater vehicles such as the NOC Autosub Long Range, as well as supporting offshore renewables design through tidal prediction and resonance modelling. NOC's Ocean Catalyst Programme further strengthens the UK marine innovation ecosystem, supporting startups and SMEs with access to specialist facilities, prototyping capability, and scientific expertise. Working with partners across government, industry, ports, and offshore energy, NOC plays a central role in advancing autonomous systems, marine resilience, and sustainable ocean use, which firmly positions the LCR as a hub for data-driven maritime innovation.



13.4 SCI-TECH DARESBUY

LOW EARTH ORBIT, DIGITAL & CONNECTIVITY CAPABILITIES FOR MARITIME

Sci-Tech Daresbury, a joint venture between the Science and Technology Facilities Council (STFC), Langtree and Halton Borough Council, is a national science and innovation campus providing the Liverpool City Region with distinctive capabilities at the intersection of space, digital infrastructure, and advanced data systems; capabilities that are increasingly critical to the future of the maritime sector.

A central asset is the Daresbury Laboratory 5G Ecosystem, which integrates terrestrial 5G with satellite communications, creating a testbed for hybrid connectivity solutions. This capability enables real-time, resilient data exchange across environments where conventional infrastructure is limited or unavailable, which could support maritime operations from ports and estuaries to the open sea.

Satellite-enabled services represent 72% of the UK's £19bn space economy, and maritime is one of the most significant application domains. Through the integration of satellite communications (Satcom), Global Navigation Satellite Systems (GNSS), Automatic Identification System (AIS), and Earth Observation (EO) data, Sci-Tech Daresbury enables innovation across vessel tracking, precision navigation, autonomous shipping, search and rescue, and maritime decarbonisation.

The ecosystem supports high-speed, low-latency connectivity, edge computing, and IoT deployment, allowing satellite data to be processed locally for faster insights and reduced bandwidth costs. Combined terrestrial-satellite architectures also deliver resilient connectivity, ensuring service continuity for safety-critical and autonomous maritime systems.

These capabilities underpin applications including smart ports, digital traffic control, environmental monitoring, coastal and spatial marine planning, oil-spill and "dark vessel" detection, and verification of AIS and insurance claims. STFC's Hartree Centre further strengthens this offer through advanced analytics, machine learning, and digital twin development, with proven maritime case studies in port operations optimisation, vessel turnaround risk reduction, and river traffic management.

Through the North West Space Cluster, delivered by STFC, businesses across the Liverpool City Region are supported to access technical expertise, test facilities, and funding routes from the UK Space Agency and European Space Agency. Together, Sci-Tech Daresbury's space-enabled digital infrastructure positions the region as a national hub for connected, data-driven, and autonomous maritime innovation, complementing its strengths in ports, shipbuilding, and clean energy.



13.5 MANUFACTURING TECHNOLOGY CENTRE (MTC)

The Manufacturing Technology Centre is a leading UK government backed research and technology organisation focused on applied advanced manufacturing innovation. It helps bridge the gap between early research and commercial industrial deployment by working with industry, academia and the public sector to develop and scale manufacturing technologies.

With a dedicated MTC site in Liverpool Science Park within the Liverpool City Region's Knowledge Quarter, this facility is designed to support local manufacturers, including those in the maritime supply chain, by providing access to technology, skills and collaboration opportunities. MTC is part of the High Value Manufacturing Catapult. Businesses in the Liverpool city region who work with MTC can access the wider pool of MTC capabilities including:

- Additive manufacturing – advanced 3D printing of metals, polymers and ceramics, supporting complex, lightweight and bespoke parts.
- Digital manufacturing, robotics & automation, laser processing – technologies that help industries improve productivity, precision and responsiveness.
- High integrity fabrication, simulation, metrology and tooling – essential for quality, performance and scaling production.



13.6 HASKONING: MARITIME ASSET RESILIENCE THROUGH TECHNOLOGY

Haskoning is an international engineering and consultancy company with deep expertise in maritime infrastructure, port and shipyard operations and digital innovation. A global team of over 850 maritime specialists focus on all aspects of engineering and advisory services for ports, terminals, shipyards, coastal and river infrastructure, supporting clients from concepts and feasibility, through master planning to detailed design and construction supervision.

Haskoning has been central to the maritime ecosystem in Liverpool City Region for over 20 years, with a dedicated office serving local clients.

Innovation is central to Haskoning's services, ranging from using drones for confined space asset inspections, 3-D modelling of port structures to monitor change, digital twins for traffic management, IoT sensing for mechanical condition monitoring, simulation for future operational flows, electric power network modelling, climate hazard data forecasting, and much more.

In the LCR, Haskoning is an important partner of the Mersey Maritime cluster, and key advisor to many regional operators, including support for strategic policy direction and innovation studies, such as green shipping corridors, but also leading in the design of key local infrastructure, such as the new Isle of Man Steam Packet terminal. Their expertise aligns closely with the ambitions of the MaLaMi PBIAA initiative, as described earlier, offering a bridge between research outcomes and real-world maritime deployment.

Haskoning are ready to support in key areas, such as:

- Digital twin integration for asset monitoring, structural health and climate impacts.
- Port and terminal technology and performance optimisation, enhancing resilience and competitiveness.
- Innovation translation, turning academic research and industrial pilots into operational impact.
- Sustainability and policy alignment, ensuring initiatives meet strategic, societal, and UKRI priorities.

By combining technical insight with strategic consultancy, Haskoning can help ensure that innovation ideas such as those which have been robustly demonstrated throughout the NMI programme in the LCR maritime ecosystem, could be delivered efficiently and effectively, accelerating adoption of innovation and embedding tangible commercial, operational and regional benefits.

"The objectives of the Navigating Maritime Innovation programme, for the LCR, aligns perfectly with the international objectives from Haskoning, where we work with our clients in "Enhancing Society Together", as our mission right across the company. Innovation to improve safety, sustainability and resilience of our maritime industry is vital to Haskoning and our clients, and so the NMI programme supports the progress of these goals. We are proud to support this initiative into the future"

- RICHARD WILLIS, TECHNICAL DIRECTOR, HASKONING



14. STRATEGIC POSITIONING GEOGRAPHIC ADVANTAGES

Liverpool's estuary and coastal geography create strong conditions for future maritime opportunity, from clean energy deployment to advanced port and vessel systems. Crucially, these natural strengths are matched by the region's national level capabilities across research, innovation, manufacturing and digital infrastructure, providing a strong platform for expansion.

14.1 THE IRISH SEA RIM

At its core, the Irish Sea Rim proposes a transnational investment, innovation and enterprise zone, connecting world-leading assets into a cohesive, globally competitive supercluster. Collectively, this network creates a powerhouse region aligned directly with the UK's Modern Industrial Strategy priorities such as advanced manufacturing, clean energy, digital and data technologies, life sciences, creative industries, and Defence.

NMI alignment:

NMI identifies the LCR as a rapidly maturing hub for clean shipping technologies, advanced vessel systems, port digitalisation, and offshore renewable integration - exactly the capabilities the Irish Sea Rim requires to function as a world-leading maritime supercluster. The region's strengths in vessel electrification, digital optimisation, advanced manufacturing, and green port operations position Liverpool as a central enabler of Irish Sea Rim objectives such as green shipping corridors, coordinated offshore testing, and cross-border decarbonisation infrastructure. This strategic integration is needed to realise a clean, blue, and green transformation across the Irish Sea. It enables coordinated marine planning, cross-border green shipping corridors, tidal and offshore renewable energy development, and the establishment of shared environmental assets such as the Irish Sea Rim Environmental and Scientific Observatory. This ensures that decarbonisation, port modernisation, and marine conservation progress hand-in-hand with economic growth.

Liverpool-Dublin twinning provides dual anchor cities driving maritime decarbonisation, digitalisation, and net-zero infrastructure across the region. Drawing on the positioning set out in CPC's Liverpool City Region Maritime Alternative Fuel Hub report, the LCR sits at a genuine geographic sweet spot within the Irish Sea Rim. Located at the centre of UK west-facing trade routes, with direct access to the Atlantic, Ireland and transatlantic corridors, the region provides a natural convergence point for shipping, offshore energy, port infrastructure and industrial demand. Its proximity to major industrial clusters in North Wales, the North West and the wider Celtic Sea zone creates a coherent arc of opportunity for alternative fuels, green shipping corridors and port-based energy transition. Within the NMI prospectus, this positioning reinforces LCR as a strategic gateway hub capable of anchoring decarbonisation and advanced maritime deployment across the wider Irish Sea Rim and beyond.

To read the full Alternative Fuel hub report click [HERE](#).



14.2 LIVERPOOL - BELFAST GREEN SHIPPING CORRIDOR

The Green Shipping Corridor Blueprint, developed through the Innovate UK-funded Pulse programme, sets out a portfolio of 29 investible pilot and demonstration projects spanning vessels, fuels, port infrastructure, digital systems, and operational innovation. This work formed part of the UK's national UK SHORE Clean Maritime Demonstration Programme (CMDC), signalling that the corridor is not a conceptual ambition but a delivery ready decarbonisation pathway.

Positioned as a flagship UK green corridor, the Liverpool-Belfast route provides a systems-based approach across the entire maritime value chain, linking fuel production, bunkering, vessel retrofit, port operations, and cross regional industrial supply chains. Its scope and maturity directly support the UK's commitment under the Clydebank Declaration to establish at least six operational green corridors by 2026.

This corridor therefore stands as a nationally significant demonstrator, anchoring investment and capability across the Liverpool City Region, Northern Ireland, and the broader UK maritime innovation ecosystem.

Details of the project and report can be found [HERE](#).

14.3 THE ISLE OF MAN - LCR & ISLE OF MAN MARITIME INNOVATION CORRIDOR

The LCR and the Isle of Man together form a uniquely powerful maritime innovation corridor within the Irish Sea, underpinned by an established Memorandum of Understanding signed by Metro Mayor Steve Rotheram and the Government of the Isle of Man. This partnership is accelerating joint capability development in digital maritime systems, offshore testing, autonomous vessels, and data-led innovation.

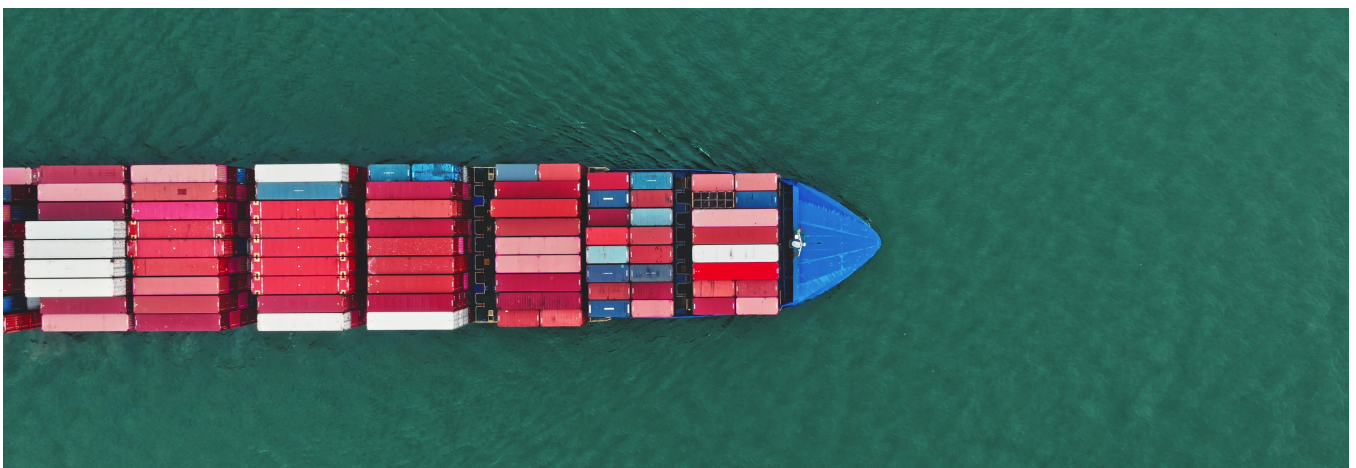
Through collaborations involving the University of Liverpool, Liverpool John Moores University, the Isle of Man Government, Isle of Man Maritime and technology partners such as Zelim (developers of advanced man-overboard and safety technologies), the two regions are creating an integrated test, trial, and validation ecosystem that connects academic excellence with real-world commercial application.

The Isle of Man provides an unparalleled asset as a living lab for the maritime sector: a controlled but operational offshore environment ideally suited for the testing of autonomous vessel systems, safety technologies, new navigation tools, and pre-commercial prototypes before deployment into wider markets. As regulatory bodies such as the Maritime Autonomous Surface Ships (MASS) Code continue to evolve, the Isle of Man's offshore waters offer a strategically advantageous proving ground while formal legislation is still being shaped.

This capability is reinforced by the establishment of a Maritime Data Asset Foundation, designed to streamline and standardise data flows, enabling smarter, AI-driven fleet operations and underpinning the emerging "AI Passport" initiative led by Zelim. Together, these developments position the region as a leader in next-generation maritime data infrastructure.

With the Isle of Man Sea Terminal in Liverpool linking both regions physically and operationally, new use cases are emerging from real-time vessel monitoring and digital twin applications to passenger safety innovation and port-side autonomous support systems.

Taken together, Liverpool and the Isle of Man now present a highly differentiated inward investment offer: a combined ecosystem where cutting-edge research, regulatory engagement, industrial capability, and offshore testing environments converge. This integrated corridor across the Irish Sea represents one of the most compelling opportunities in the UK for maritime technology development, commercialisation, and global market scaling.



14.4 THE CELTIC SEA

The Liverpool City Region (LCR) occupies a structurally advantageous position at the intersection of the Irish Sea, the North Welsh coast, and the wider Celtic Sea energy basin. The NMI dataset evidences a maritime ecosystem characterised by advanced technologies (~£720m–£886m identified), significant future energy investment (~£320m–£342m), and corporate-led infrastructure transformation. When viewed against the expanding renewable and port activity across North Wales and the Celtic Sea, a clear geographical complementarity emerges. The Celtic Sea and North Welsh coast are increasingly defined by:

- Offshore wind expansion (fixed and floating)
- Emerging marine energy testbeds
- Grid reinforcement and transmission upgrades
- Port-side electrification and hydrogen readiness

The Liverpool City Region, by contrast, demonstrates through NMI data:

- Vessel retrofit capability (dual-fuel, transitional propulsion)
- Advanced digital port and logistics systems
- Shipbuilding and industrial fabrication capacity
- SME innovation in energy optimisation and distributed renewables
- HEI-led research aligned to maritime decarbonisation

This creates a natural east–west maritime innovation corridor across the Irish Sea basin, where generation, transmission, vessel adaptation, port integration, and digital optimisation form a contiguous system rather than isolated projects.

NMI findings also show strong alignment across interlocking pathways:

10. Fuel and propulsion transition

Large corporate retrofit programmes and propulsion conversion plans in the LCR complement offshore renewable generation growth in the Celtic Sea. As renewable electricity and green fuel production scales west of the region, the LCR's vessel conversion and port integration capabilities could provide the demand-side deployment mechanism.

2. Distributed and hybrid future energy systems

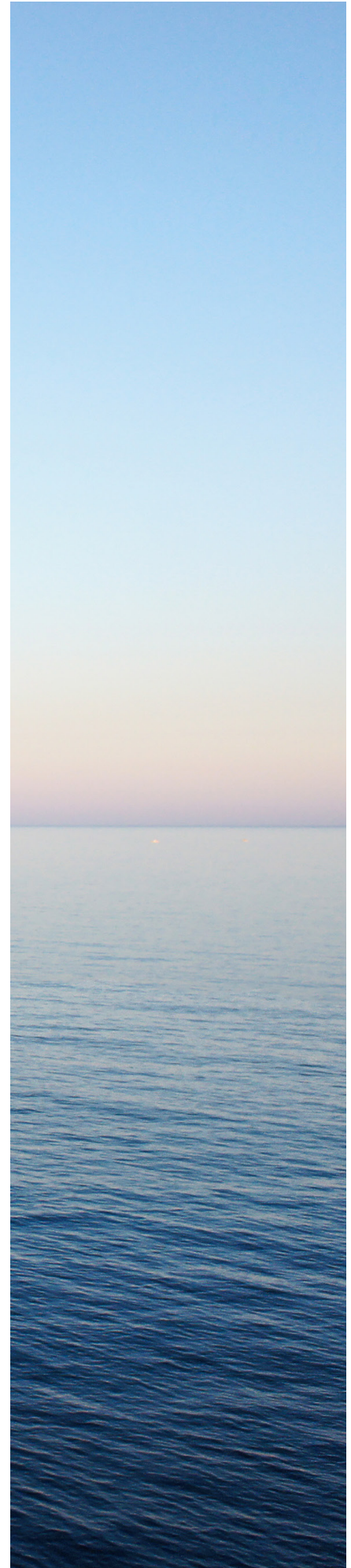
SME and HEI innovations in onboard generation, energy monitoring, and optimisation complement large-scale infrastructure. This layered ecosystem strengthens resilience across vessel, port, and offshore asset networks.

Strategic Implication

The NMI dataset indicates that the Liverpool City Region is operating at infrastructure scale in both advanced technology and future energy themes. Positioned within the wider Celtic–Irish Sea system, this enables the region to act as:

- A vessel conversion and retrofit hub
- A digital maritime systems integrator
- A port-side energy interface
- A collaboration bridge between offshore generation and maritime deployment

The geographical positioning of the LCR therefore represents not only proximity advantage, but systemic advantage where technological capability, infrastructure scale, and renewable expansion across the Celtic and North Welsh Sea converge into a coherent, investable maritime energy transition corridor.



15. FOREIGN DIRECT INVESTMENT OPPORTUNITIES

The NMI project highlights a substantial and diverse pipeline of investable opportunities across the LCR, positioning the maritime cluster as a strategic destination for Foreign Direct Investment (FDI).

With 188 innovation projects identified including significant proportions in the £1m–£5m, £5m–£20m, and £20m+ ranges, the region presents a depth of opportunities aligned with global priorities in clean energy, future fuels, advanced vessel design, digitalisation, and port automation.

Crucially, the data also shows a cohort of early-stage or aspirational projects which, without targeted investment or grant support, risk being delayed, displaced, or ultimately delivered outside the region. Ensuring these projects are backed early is essential to securing their economic value within the LCR, strengthening the supply chain, and preventing competitive regions both in the UK and internationally from capturing the associated jobs, skills, and inward investment.

The region's attractiveness to investors is further enhanced by its growing international maritime partnerships, including the strategic twinning with the Port of Busan (South Korea) one of the world's largest and most technologically advanced ports and active collaboration with the Port of Hamburg (Germany), a global leader in port digitalisation and energy transition. These relationships provide LCR businesses and innovators with access to global markets, joint R&D pathways, and opportunities for international scale up, reinforcing the cluster's position within global maritime value chains.

Together with the advantages of the LCR Freeport, the Investment Zone designation, and the region's strong academic and industrial base, this pipeline represents a compelling, time-sensitive opportunity for global investors.





16. RECOMMENDATIONS

16.1 DIRECTIONALITY, FUTURE FUNDING OPPORTUNITIES AND LCR CAPACITY BASED ON FINDINGS

"As regulatory requirements continue to evolve, particularly around decarbonisation, safety, and assurance, the way ports and ship operators approach inspection and compliance will have to change. We are seeing increasing expectations around the use of digital systems, remote and drone-based inspection, and verified data to support everything from hull condition and asset integrity through to shore power connection, charging, and coupling."

- **MIKE WILLIAMS, MARINE & OFFSHORE SERVICE DELIVERY
MANAGER, UK & IRELAND AT LLOYD'S REGISTER**





16.2 ADVANCED TECHNOLOGY

The NMI dataset demonstrates that advanced technology represents one of the Liverpool City Region's most strategically significant areas of opportunity. With 128 identified projects across digital systems, automation, AI, simulation, robotics, additive manufacturing and advanced vessel technologies, the region is clearly positioned for national leadership in smart maritime systems.

From our perspective as the sector's representative body, this is a pivotal moment. The region's innovation capability is no longer theoretical, the projects emerging across LCR are commercially deployable, scalable, and aligned with real operational needs in ports, vessels, logistics and energy systems.

Our Recommendations

1. Accelerate investment in maritime digitalisation

LCR has the capability to lead the UK in maritime digital systems, including digital twins, predictive analytics, AI-driven optimisation and integrated operational platforms. Investment should focus on:

- Port wide and vessel linked digital twin ecosystems
- Predictive maintenance and optimisation tools
- AI enabled decision making for routing, planning and asset health
- Integrated cyber physical security frameworks for critical infrastructure

These technologies will define the next generation of port and vessel operations.

2. Develop LCR as a national testbed for automation and autonomy

Across the dataset, autonomous and semi autonomous systems form a growing capability area. LCR should establish itself as a UK hub for:

- Autonomous vessel trials and simulation
- Remote monitoring and control systems
- Robotics for inspection, maintenance and cargo operations
- Infrastructure ready for future autonomous port interfaces

3. Strengthen advanced manufacturing and scale up capacity

The region's capability in advanced manufacturing, including additive manufacturing, high integrity fabrication, digital production and material innovation, must be integrated into maritime deployment pathways. SMEs should be supported with:

- Access to prototyping facilities
- Technology adoption programmes
- Scale up and commercialisation support

4. Drive collaborative development models

With 89% of project leaders seeking partners, collaboration is one of the region's strongest assets. Mersey Maritime recommends coordinated multi stakeholder partnerships that link industry, academia, ports and innovators to deliver large scale, commercially focused technology programmes.

16.3 DECARBONISATION

Decarbonisation is one of the most urgent and economically significant themes identified through NMI, with 39 projects and an estimated £696m in innovation activity. These span clean fuels, emissions reduction technologies, vessel retrofits, shore power, energy optimisation, and port side interventions.

From the vantage point of the cluster, decarbonisation represents both a regulatory imperative and a major competitive opportunity for the LCR.

Our Recommendations

1. Prioritise scalable emissions reduction technologies

The region should focus on accelerating technologies capable of delivering near term emissions reduction, including:

- Air lubrication systems
- Static wing sails and wind assist technologies
- Hybrid propulsion and energy efficiency systems
- Digital optimisation tools for fuel reduction

2. Expand regional capability in vessel retrofit and upgrade programmes

The LCR has the industrial capacity to become a national centre of excellence for low carbon vessel retrofits. We recommend creating:

- A coordinated regional retrofit programme
- Standardised pathways for clean technology installation
- Joint funding bids for multi vessel trials

3. Accelerate port side decarbonisation

Port estates must become early adopters of decarbonisation technologies. LCR should prioritise:

- Shore power and future charging infrastructure
- Renewable energy expansion (solar, wind, hybrid systems)
- Low carbon fuels transition for port plant and logistics equipment

4. Expand collaborative funding and co development pathways

With 99% of decarbonisation projects seeking collaboration, Mersey Maritime recommends the creation of joint funding consortia to access UK SHORE (including CMDC and ZEVI) and UKRI mechanisms.



16.4 FUTURE ENERGY

Future energy represents a strategically critical theme with 20 projects and £342m of identified potential. These involve hybrid fuels, hydrogen and ammonia systems, shore power, battery storage, energy resilience, and next generation bunkering and distribution capabilities.

The region is well placed to lead the UK in clean maritime energy systems due to its industrial footprint, port infrastructure, and growing future fuel ecosystem.

Our Recommendations

1. Develop a coordinated regional future energy roadmap

The LCR should define a unified strategy for future maritime fuels covering:

- Hydrogen, methanol, ammonia and hybrid fuel pathways
- Electrification and large scale charging
- Grid scale storage and energy resilience
- Bunkering infrastructure and fuel logistics

2. Position the LCR as a national demonstrator for integrated clean energy systems

We recommend developing test and deployment sites for:

- Port side energy hubs
- Advanced charging networks
- Modular energy systems
- Fuel blending, storage and bunkering innovations

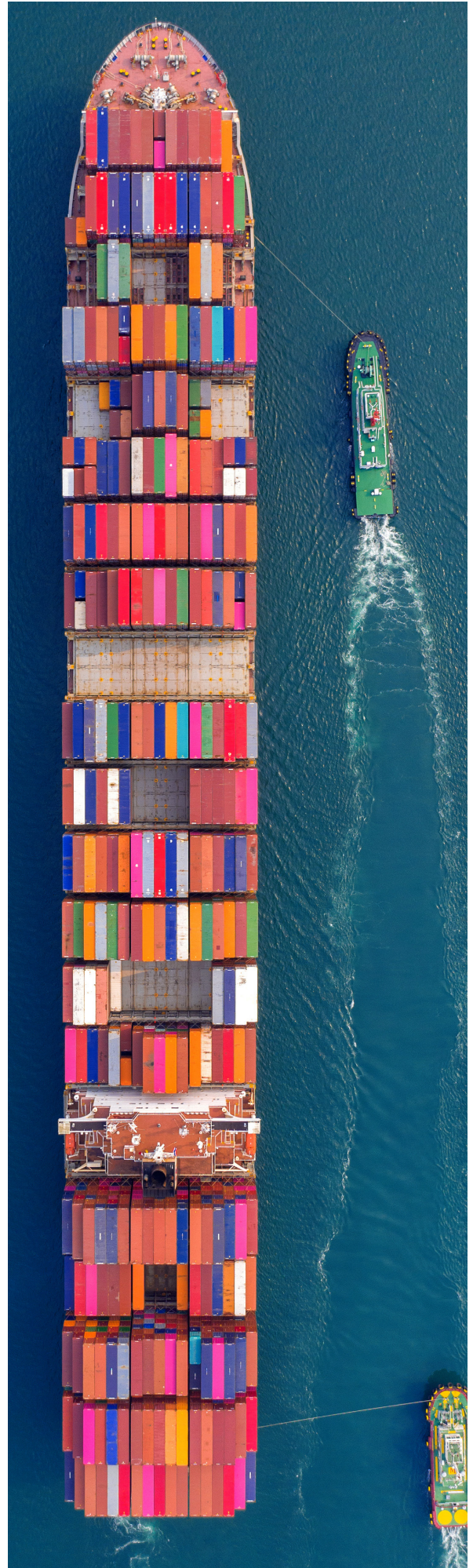
3. Accelerate SME and industry innovation in distributed and hybrid energy systems

SMEs play a crucial role in energy innovation. They should be supported through:

- Access to test facilities
- Partnerships with corporates and HEIs
- Targeted investment vehicles for energy technologies

4. Create innovation ready infrastructure for large scale fuel transition

Investment in multi fuel port infrastructure will be essential to support alternative fuels, vessel conversion programmes and future focused logistics.



16.5 DEFENCE

The NMI dataset highlights the LCR as an emerging powerhouse in maritime defence capability, supported by shipbuilding, advanced manufacturing, autonomy, digital systems, and multi domain testing environments.

With national defence requirements evolving rapidly, the region is strategically well positioned to contribute.

Our Recommendations

1. Position LCR as a key contributor to future naval shipbuilding and systems integration

The region should leverage its strong industrial base to support:

- Future naval vessel programmes
- Modular systems integration
- Digital engineering and simulation capabilities
- Dual use maritime technologies

2. Accelerate autonomous and unmanned systems development

The defence sector is moving toward distributed, autonomous and semi autonomous systems. LCR can lead in:

- Surface and subsea autonomous vessel development
- Sensor systems, command platforms and digital navigation
- AI enabled decision support and mission systems

3. Establish controlled test and evaluation corridors across the Irish Sea and Isle of Man

We recommend formalising regional testing environments suitable for:

- Autonomous vessel trials
- Multi domain defence applications
- Cyber physical resilience testing

4. Strengthen the North West defence corridor

With proximity to Barrow, national defence primes, and advanced manufacturing clusters, the LCR can expand its role within a broader North West defence ecosystem.

5. Align regional innovation with national strategic requirements

LCR capability is uniquely aligned with emerging defence priorities, including autonomy, AI, cyber resilience, maritime domain awareness and low carbon platforms. The region should develop:

- Defence focused innovation partnerships
- Supply chain acceleration programmes
- Standards and certification pathways for dual use technologies



17. UNLOCKING LIVERPOOL'S MARITIME INNOVATION POTENTIAL

17.1 VESSEL OF THE FUTURE

Whilst there are of course many nuances to the creation of new vessels, it is possible to imagine a hypothetical opportunity in the form of future vessel design. The NMI project clearly outlines the Liverpool City Region's maritime sector as a demonstrably rich innovation ecosystem. A significant opportunity exists alongside an emerging necessity. Ongoing regulatory drivers, such as the Inter-Sessional Working Group on Reduction of Greenhouse Gas (GHG) Emissions from Ships (IMO ISWG) deliberations, and wider international decarbonisation requirements, are accelerating the need for vessel redevelopment at scale.

Within this context, there is a compelling case not only to envision a vessel of the future, but to design, develop, and realise it within the Liverpool City Region.

Such a vessel could integrate complementary renewable energy systems, including static air-wing technologies mounted directly to the deck to harness wind propulsion, operating in tandem with photovoltaic surfaces to provide auxiliary power during periods of low wind, particularly on long, trans-global voyages. These systems could be further enhanced through advanced hull innovations, such as passive air-lubrication and other drag-reduction technologies, significantly improving overall fuel efficiency.

The vessel could operate using fully autonomous or semi-autonomous systems, enabled by low Earth orbit satellite communications and advanced digital platforms capable of continuously mapping, monitoring, and optimising vessel performance in real time with the latest AIS based analysis. This doesn't just stop at long haul trans-Atlantic vessels but also major changes in hinterland canal way barge logistics could also benefit from many of the same innovations.

Along corridors such as the Manchester Ship Canal, semi-autonomous electric or hydrogen-powered barges could operate in synchronised convoys, optimised around lock scheduling, tidal windows and port-side charging availability. Smart containers equipped with IoT sensors could transmit cargo condition, location, customs status and energy requirements in real time, enabling predictive supply chain management rather than reactive handling.

In this model, inland waterways become extensions of the smart port ecosystem. Barge movements could be algorithmically coordinated to reduce congestion, minimise idle time at locks, and align precisely with deep-sea vessel discharge schedules. Combined with shore-based renewable generation - photovoltaics, wind, tidal or grid-balanced storage - the entire inland freight system could transition toward a low-carbon, digitally orchestrated logistics network.

The indicative vessel described here could also benefit from a range of modernised green fuel and hybrid energy systems to propel itself as, crucially, this vision extends beyond the vessel and into supporting port-side infrastructure, such as methanol or alternative fuel bunkering, coupling the vessel directly with future initiatives already underway at Stanlow, and part of Peel Ports' green shipping corridor aspirations.

High-capacity electrical charging, supported with renewable power and smart allocation plus digitally enabled maintenance facilities, could be developed across the port estate. This would enable a closed-loop, holistic maritime ecosystem, where large-scale, automated, low-emission vessels are designed, built, operated, maintained, and refuelled locally.

Taken together, the opportunity to re-ignite a globally unique, end-to-end maritime innovation system in the Liverpool City Region, is an achievable goal.



17.2 PORT OF THE FUTURE

Continuing this idea, imagine a port fully integrated through advanced digital systems, where real-time data exchange enables seamless cross-communication across all operations. Drawing on proven approaches already demonstrated by regional innovators, berth allocation, vessel scheduling, and cargo handling are dynamically optimised in harmony with energy demand, grid conditions, and deployment timing. These systems are underpinned by next-generation photovoltaics, renewable energy integration, and hydro-electric generation technologies currently being developed and trialled within the sector delivering efficiency, resilience, and sustainability at scale.

From ship to shore, the port operates with precise control and situational awareness. Innovations already observed throughout the NMI programme could enable coordinated management of TEU capacity, crane utilisation, personnel safety, and cyber-physical security through secure, AI-driven platforms. End-to-end visibility across embarkation and disembarkation is enabled by ubiquitous 5G connectivity and interoperable data standards creating a common digital language that unifies all cargo, container, and logistics flows.

Resilience is embedded by design. NMI data has highlighted advanced cyber capability which is easily transferable for defence and security architectures, capable of mitigating emerging digital and physical threats to critical infrastructure. These include predictive monitoring, autonomous response systems, and robust cyber security frameworks that protect against future risks such as system intrusion, disruption, or hijack scenarios ensuring continuity of operations under all conditions.

Beyond operational excellence, the port becomes a catalyst for green growth and regional transformation. Existing infrastructure and high-tech real estate form a living testbed for future innovation, enabling rapid translation from R&D to deployment.

Innovators working across maritime, aerospace, low-Earth orbit systems, advanced electrification, and grid-scale energy systems would be able to trial, validate, and scale technologies within a real-world operational environment. With a substantial and reliable 'baseload', the port functions as both an energy anchor for innovative new offshore renewable coupling and an innovation platform.

The impact for the region's future would be profound. By building directly on capabilities already present, this vision unlocks opportunities on a scale not previously seen, driving productivity, accelerating commercialisation, and attracting sustained inward investment. It strengthens and future-proofs maritime employment while opening entirely new markets, delivering a significant uplift in high-skill, high-value jobs and establishing the region as a national and global leader in maritime innovation.

17.3 FUTURE ENERGY

NMI has demonstrated that decarbonisation in the LCR is not only feasible but highly achievable through the integration of multiple, complementary energy technologies. The region benefits from a rare convergence of large-scale, innovation-ready corporates alongside a dynamic base of SMEs and academic institutions capable of designing, testing, and delivering next-generation energy systems. This creates a strong foundation for a coordinated transition toward a resilient, low-carbon energy ecosystem.

Future energy initiatives already represent approximately 18% of the total estimated £1.9bn NMI project value, signalling both emerging maturity and significant headroom for growth. NMI has identified credible regional capabilities across small modular nuclear reactors (SMRs), offshore energy systems, hydroelectric infrastructure, photovoltaics, and wind technologies. Organisations such as Core Power, Arup, Peel Ports, Grafmarine, and GT Wings exemplify the breadth of expertise available, spanning concept design through to deployment and operation.

Importantly, these technologies should not be viewed in isolation. A "system of systems" approach, combining baseload generation (such as SMRs), intermittent renewables (offshore wind and photovoltaics), and novel mechanical and subsea energy capture technologies, offers the potential to create a modular, resilient energy architecture. Such an approach would enhance energy security, support port and industrial decarbonisation, and enable scalable adoption across maritime, logistics, and adjacent sectors.

Beyond economic and industrial impact, this transition presents significant public value. Improved air quality resulting from reduced reliance on fossil fuels offers meaningful opportunities to address longstanding regional health challenges, including elevated rates of air-quality-related conditions. By aligning future energy development with industrial capability, health outcomes, and environmental resilience, the Liverpool City Region is well positioned to establish itself as a nationally significant demonstrator for integrated, clean maritime energy systems. Crucially, NMI evidence shows that much of this opportunity is driven by substantial industry-led investment and innovation excellence.



18. CLOSING STATEMENT

It has been shown through the Navigating Maritime Innovation project that the LCR innovation capability is strong and is fully underway in developing a solid future of sectoral resilience. Through the project, we have revealed a vibrant, sophisticated ecosystem that is already independently innovating with ambition and world class expertise.

What this work uncovers is powerful. The maritime sector in the Liverpool City Region is already home to:

- ✓ Advanced digital technologies
- ✓ Clean energy solutions
- ✓ Automation and autonomy
- ✓ AI-led logistics
- ✓ Materials innovation
- ✓ Vessel efficiency research, and
- ✓ Cutting-edge manufacturing capabilities

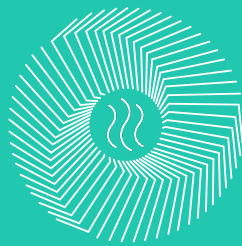
These activities demonstrate the region's existing strengths, its readiness to scale and collaborate. This is reinforced by a substantial £1.9 billion innovation pipeline - a clear, evidence-based opportunity for greater support in the form of future devolved public investment which could rapidly accelerate economic growth and deliver national impact.

The findings show that the Liverpool City Region's maritime sector possesses a rare combination of assets, globally recognised research institutions, a diverse and inventive innovation community, deep industrial expertise, and the strategic presence of a major international port and other maritime prime businesses who together, as a cluster, are able to work decisively on mutual growth. Collectively, they position the region not as a sector waiting to emerge, but as one whose capabilities are now being fully understood, connected, and leveraged. The NMI project has been instrumental in spotlighting this thriving sector.

As equally important, the prospectus can further enhance how maritime organisations strengthen their competitiveness by engaging with innovators from sectors not traditionally associated with maritime, such as robotics, advanced materials, digitalisation and AI, immersive technologies, and clean-tech. These cross-sector collaborations offer new pathways to efficiency, resilience, sustainability, and long-term market advantage.

This prospectus highlights the scale of opportunity. It brings to light the projects, capabilities, and partnerships that firmly establish the Liverpool City Region as one of the UK's most compelling locations for maritime innovation driving growth, delivering cleaner industry, and securing a globally relevant maritime future.





NAVIGATING MARITIME INNOVATION

IN THE LIVERPOOL CITY REGION