The Global Offshore Low Carbon Energy Sector 2025 Annual Review: Strategic Implications for North East Scotland Energy Supply Chain SMEs

Executive Summary

The global offshore low carbon energy sector's transformation in 2025 presents North East Scotland energy supply chain SMEs with the most significant commercial opportunity since the North Sea oil and gas boom of the 1970s-1980s. With 19.6 GW of offshore wind deployed globally, €240 billion committed to European hydrogen infrastructure, £9.4 billion allocated to UK CCUS clusters, and £2+ billion annual decommissioning expenditure on the UKCS, the region stands at a critical inflection point.

> Companies that successfully transition capabilities from hydrocarbon services into offshore wind, hydrogen, CCUS and decommissioning will capture sustained revenue streams through 2040 and beyond, while those that delay risk obsolescence as the energy transition accelerates.

This report examines the strategic implications of 2025 market developments for North East Scotland SMEs, identifying specific opportunities, competitive positioning strategies, market entry pathways, capability development priorities, partnership models, and risk mitigation approaches. The analysis is grounded in the reality that North East Scotland possesses world-class offshore engineering expertise, established port infrastructure, a skilled workforce, and proximity to major UK and European offshore energy projects—assets that position the region as a natural beneficiary of the energy transition if companies act decisively.

The detailed paper is a follow-up to our recent report Global Offshore Low Carbon Energy Sector - 2025 Annual Review

The Strategic Context: Why 2025 Matters for North East Scotland

The North Sea Energy Transition is Accelerating

The UK Government's North Sea Future Plan, published in November 2025, crystallized the managed energy transition framework that will define the region's industrial trajectory through 2040. The plan permits limited oil and gas production via Transitional Energy Certificates while simultaneously committing £63 billion in clean energy investment, maintaining the 78% windfall tax on hydrocarbons,

and establishing a five-year rolling forecast of clean energy projects to enable supply chain planning. For North East Scotland SMEs, this represents clarity: oil and gas decline is managed but inevitable, decommissioning will dominate 2025-2040, and clean energy investment is committed and accelerating.

The "goldilocks window" identified by Robert Gordon University's Energy Transition Institute is now fully open—the critical 5-7 year period when offshore infrastructure, skilled workforce, and capital remain available to pivot from hydrocarbons to renewables before assets are decommissioned and expertise disperses.

Companies that transition capabilities during this window will benefit from first mover advantages, established customer relationships, and the ability to shape emerging supply chains. Those that wait risk competing against Asian manufacturers, European engineering firms, and new entrants without legacy infrastructure advantages.

Global Market Scale Creates Export Opportunities

The global offshore low carbon energy market reached unprecedented scale in 2025, with total addressable market value exceeding $200 billion annually when combining offshore wind ($80B), hydrogen investment ($8B), CCUS ($5B), marine energy, grid infrastructure, and decommissioning. This market is projected to grow substantially through 2030, with offshore wind installations alone forecast to reach 244 GW globally (more than double 2025 levels), hydrogen production scaling to 16+ million tonnes annually, and CCUS capacity expanding toward 430 Mt CO_2 per year.

Critical for North East Scotland SMEs, much of this growth will occur in regions with limited domestic offshore engineering capacity—Southeast Asia (Vietnam, Philippines, Indonesia), emerging European markets (Poland, Baltic states, Celtic Sea), and potentially a recovering US market post-2028. Companies that establish early presence in these markets through partnerships, demonstration projects, or direct investment will benefit from sustained work pipelines as regional markets mature.

Scotland's offshore wind pipeline alone—over 40 GW across ScotWind, INTOG, and Celtic Sea projects—represents £100+ billion in capital investment requiring fabrication, installation, grid connection, and long-term operations and maintenance services. With operational lifespan of 25-30 years, projects reaching FID in 2025-2027 will generate revenue streams through 2050-2060, providing multi-decade business visibility for companies securing contracts.

Technology Convergence Creates Integrated Opportunities

The 2025 Annual Review demonstrated decisively that offshore wind, hydrogen production, carbon capture, and decommissioning are converging into integrated infrastructure systems rather than remaining separate technology silos. EMEC's successful demonstration of tidal power integrated with battery storage and hydrogen production validated hybrid renewable systems for coastal applications. The Asian Development Bank's policy shift enabling CO_2 storage in decommissioned oil and gas platforms created pathways for infrastructure repurposing. The EU's €240 billion hydrogen grid investment emphasizes offshore wind-to-hydrogen integration and subsea pipeline corridors.

For North East Scotland SMEs, this convergence represents a strategic opportunity: companies with cross-sector capabilities in offshore operations, subsea engineering, high-pressure systems, and project management can offer integrated services commanding premium margins, while competitors locked into single-technology specializations face commoditization pressure. The ability to deliver platform conversion (oil/gas to CO_2 storage), offshore electrolysis systems (wind-to-hydrogen), or hybrid energy islands positions firms as strategic partners rather than interchangeable subcontractors.

Opportunity Landscape: Where North East Scotland Can Win

Opportunity #1: Offshore Wind Supply Chain—Fabrication, Installation, and O&M

Market Scale and Timeline

Scotland's offshore wind pipeline includes 28 GW of ScotWind projects, 5+ GW of INTOG developments, and participation in Celtic Sea Round 5 floating projects (up to 4.5 GW), representing cumulative capital investment exceeding £80 billion through the 2030s. UK-wide, over 40 GW of consented or pipeline offshore wind capacity will require domestic supply chain support, with the Offshore Wind Industrial Growth Plan targeting tripling of manufacturing capacity and 100,000+ sector jobs by 2030.

The Crown Estate's £13 million Supply Chain Accelerator funding for 16 projects, including floating infrastructure, automated mooring systems, and low-carbon scour protection, signals sustained investment in capability development. Port infrastructure investments—£55 million for Cromarty Firth, £24.3 million for Kishorn Port, and ongoing expansions at Nigg, Ardersier, and Dundee—create fabrication and assembly capacity specifically designed for floating wind and large-scale offshore structures.

Specific Opportunities for North East Scotland SMEs

- **Foundation engineering and fabrication:** Monopile transition pieces, jacket structures, and floating foundation manufacturing (semi-submersible, spar-buoy designs) leveraging existing oil and gas fabrication expertise.
- **Subsea cable systems:** Design, fabrication, installation, and repair of array cables, export cables, and dynamic cables for floating wind, with particular demand for 66kV and 132kV systems and HVDC export infrastructure.
- **Mooring and anchoring systems:** Specialized mooring design, anchor fabrication, and installation services for floating foundations in 60-200m water depths, a capability directly transferable from offshore oil and gas.
- **Installation support:** Jack-up barge services, heavy-lift vessel support, marine coordination, and offshore logistics for foundation and turbine installation campaigns.
- **Operations and maintenance:** Crew transfer vessels, walk-to-work systems, onshore and offshore O&M bases, predictive maintenance systems, and spare parts logistics for 25+ year operational life.
- **Offshore substations and platforms:** Fabrication and installation of offshore substation platforms, HVDC converter platforms, and hydrogen production platforms for future integrated wind-hydrogen projects.

Competitive Advantages

North East Scotland possesses distinct advantages in offshore wind supply chains: proximity to major UK project sites (Moray Firth, Scottish North Sea, Celtic Sea), established port infrastructure with heavy-lift capabilities, a workforce with deep offshore experience including crane operations and marine logistics, and existing relationships with major developers (SSE, BP, Ocean Winds, Vattenfall).

Companies leveraging these advantages through early positioning, capability demonstrations, and strategic partnerships will capture disproportionate value as ScotWind and INTOG projects reach construction phases 2026-2030.

Opportunity #2: Hydrogen Infrastructure—Production, Storage, Transport

Market Scale and Timeline

The EU's €240 billion hydrogen grid investment through 2040 and endorsement of 100 hydrogen Projects of Common Interest creates a structured, decade-long infrastructure pipeline. The UK's Project Union—including the St Fergus to Teesside hydrogen pipeline—received £164 million in FEED funding and will

require substantial fabrication, pipeline construction, compression systems, and monitoring infrastructure through 2027-2030 construction phases. Scotland's position as a hydrogen production hub is reinforced by Acorn CCUS development funding (£200+ million additional allocation), Aberdeen Hydrogen Hub progress, and strategic location connecting Scottish renewable generation with industrial demand centers in Teesside, Grangemouth, and Northwest England.

Global hydrogen investment rising 70% to $8 billion in 2025, with over 1,570 projects across 70+ countries, creates export opportunities for companies establishing hydrogen expertise. Southeast Asia—particularly Malaysia's green hydrogen initiatives, Singapore's low-carbon hydrogen with CCUS, and emerging ASEAN hydrogen corridors—represents high-growth markets with limited domestic hydrogen engineering capacity.

Specific Opportunities for North East Scotland SMEs

- **Pipeline engineering and fabrication:** High-pressure hydrogen pipeline design, fabrication, welding (specialized H_2-compatible materials), coating, inspection, and NDT services for transmission networks and industrial distribution systems.
- **Compression and storage systems:** Hydrogen compressor station engineering, reciprocating and centrifugal compressor supply, underground storage facility development (salt caverns, depleted fields), and above-ground pressure vessel fabrication.
- **Electrolyzer integration:** Balance-of-plant engineering for large-scale electrolyzers (100+ MW), electrical integration with offshore wind or grid power, water treatment systems, and hydrogen purification and quality control systems.
- **Hydrogen metering and monitoring:** Flow measurement systems for custody transfer, leak detection and monitoring equipment, safety systems for hydrogen handling, and emissions verification technologies.
- **Offshore hydrogen production platforms:** Conceptual design and engineering for offshore electrolysis platforms, integration of wind power and electrolyzers on converted oil/gas platforms, and subsea hydrogen export pipeline systems.
- **Industrial offtaker integration:** Retrofitting industrial facilities (refineries, chemical plants, steel mills) for hydrogen use, hydrogen blending systems for existing gas infrastructure, and process engineering for hydrogen as feedstock.

Competitive Advantages

North East Scotland's hydrogen opportunity builds directly on oil and gas heritage: high-pressure pipeline construction expertise, process engineering capabilities, subsea systems integration, and project management experience all transfer directly to hydrogen applications. The region's proximity to St Fergus (a critical hydrogen and CCUS hub), existing gas processing infrastructure, and established relationships with industrial offtakers create natural first-mover advantages.

Companies like Hydrasun demonstrate the viability of this transition, having successfully applied fluid transfer and power control expertise to 40 global hydrogen projects including the Aberdeen Hydrogen Hub. SMEs that follow similar pathways—investing in hydrogen-specific training, securing demonstration project contracts, and building partnerships with electrolyzer OEMs or hydrogen project developers—will establish track records enabling sustained growth as the hydrogen economy scales.

Opportunity #3: CCUS Infrastructure—Capture, Transport, Storage

Market Scale and Timeline

The UK's £9.4 billion CCUS cluster funding for Acorn (Scotland), Viking (Humberside), East Coast Cluster, and HyNet represents the largest public commitment to carbon management infrastructure globally and signals regulatory conviction that projects will reach FID and construction in 2026-2028. Acorn specifically—led by Storegga and designed to leverage St Fergus infrastructure for CO_2 storage in depleted North Sea fields—is positioned as Scotland's flagship energy transition project, with development funding enabling detailed engineering and supply chain mobilization.

Global CCUS capacity expanding from 50 Mt to 75 Mt CO_2 per year in 2025, with projections toward 430 Mt by 2030 and potentially 2,000 Mt by 2050, creates sustained demand for specialized engineering services. The Asian Development Bank's policy shift enabling CO_2 storage in depleted oil and gas fields across ASEAN opens substantial export opportunities in Indonesia, Malaysia, Thailand, and Vietnam—markets where North East Scotland expertise in offshore platform operations and subsea systems is highly relevant.

Specific Opportunities for North East Scotland SMEs

- **CO_2 pipeline infrastructure:** Design, fabrication, and installation of CO_2 export pipelines (subsea and onshore), specialized welding and coating for CO_2 service, pipeline integrity management and inspection, and compression station engineering.

- **Platform conversion services:** Engineering studies for converting decommissioned platforms to CO_2 injection facilities, wellhead modification for CO_2 injection, platform life extension and structural integrity assessment, and offshore injection control systems.
- **Subsea infrastructure:** Subsea manifolds and wellhead equipment for CO_2 injection, flowline and riser systems, subsea control systems, and remotely operated vehicle (ROV) services for installation and maintenance.
- **Monitoring and verification:** Reservoir monitoring systems (seismic, pressure, temperature), CO_2 plume tracking and modeling, leak detection systems (subsea and surface), and environmental monitoring and reporting.
- **Storage site development:** Geological characterization and reservoir engineering, well integrity assessment and remediation, capacity certification and risk assessment, and regulatory compliance and permitting support.
- **Industrial capture systems:** Engineering for post-combustion capture at industrial facilities, solvent systems and absorption columns, heat recovery and integration, and emissions measurement and verification.

Competitive Advantages

North East Scotland's CCUS advantage stems from its unique combination of depleted hydrocarbon fields suitable for CO_2 storage, existing subsea infrastructure that can be repurposed, engineering firms with deep well integrity and reservoir management expertise, and the Acorn project providing a domestic anchor customer and technology demonstration platform. The region's established relationships with oil and gas operators (Shell, TotalEnergies, BP, Harbour Energy) who control storage sites create natural partnerships for CCUS development.

The convergence of decommissioning and CCUS creates particularly compelling opportunities: companies offering integrated services that assess end-of-life platforms for storage conversion, conduct well integrity evaluations, design CO_2 injection systems, and manage platform life extension can capture value from both the decommissioning backlog and the CCUS build-out. This "platform conversion model"—converting liabilities (decommissioning obligations) into assets (storage infrastructure)—is estimated to be 40-60% cheaper than greenfield CCUS development, creating strong commercial incentives.

Opportunity #4: Decommissioning and Infrastructure Repurposing

Market Scale and Timeline

UKCS decommissioning expenditure exceeded £2 billion for the first time in 2024, with forecasts projecting average annual spending of nearly £3 billion throughout the decade. The sector faces substantial backlogs: 153 wells in arrears for plugging and abandonment, 124 wells decommissioned in 2024 against a target of 300 per year, and projections indicating decommissioning spending could overtake new oil and gas capital investment by 2028. This creates sustained demand for well P&A services, subsea infrastructure removal (95,000 tonnes of infrastructure and 883 km of pipelines planned), platform topsides and jacket removal (10 topsides and 12 jackets removed in 2024 alone), and onshore recycling and materials handling.

Aberdeen-based IKM Testing reported £6.5 million in decommissioning revenue for 2025 and is expanding service scope and headcount for 2026, demonstrating strong market confidence and the viability of decommissioning as a growth business. The North Sea Transition Authority's enforcement of decommissioning obligations, combined with operators' economic incentives to exit marginal fields under the 78% tax regime, ensures sustained activity through at least 2035-2040.

Specific Opportunities for North East Scotland SMEs

- **Well plugging and abandonment:** Specialized well P&A services including wireline operations, coiled tubing, cementing, and section milling; subsea well intervention and abandonment; conductor cutting and removal; and environmental monitoring during abandonment.
- **Subsea infrastructure removal:** Cutting and recovery of subsea manifolds, flowlines, and risers; pipeline decommissioning (flushing, cutting, recovery); subsea structure removal; and seabed clearance and restoration.
- **Platform decommissioning:** Topsides removal engineering and execution, jacket cutting and removal (diamond wire sawing, underwater cutting), heavy-lift marine operations, and onshore dismantling and recycling.
- **Infrastructure repurposing studies:** Techno-economic assessment of platforms suitable for conversion to CO_2 storage or hydrogen production, engineering for platform life extension and modification, regulatory pathway navigation for change-of-use applications, and project management for repurposing campaigns.
- **Materials handling and recycling:** Onshore receiving and processing facilities, steel and materials recycling and resale, waste treatment and disposal, and circular economy value recovery.

- **Environmental services:** Pre-decommissioning environmental surveys, marine environmental monitoring during operations, post-decommissioning site assessments, and biodiversity restoration services.

Competitive Advantages

North East Scotland dominates UK decommissioning through established supply chains, purpose-built onshore facilities (Dales Voe, Kishorn, Nigg, Dundee), specialist contractors with NSTA-approved methodologies, and geographic proximity to UKCS infrastructure requiring decommissioning.

The region's expertise in heavy-lift operations, subsea cutting, and well intervention transfers directly to international markets, with emerging opportunities in Southeast Asia (Indonesia, Malaysia, Thailand) as those regions begin confronting their own decommissioning obligations in the late 2020s-2030s.

The strategic value of decommissioning extends beyond direct service revenue: companies establishing decommissioning track records gain credibility for infrastructure repurposing projects (CCUS conversion, wind farm O&M bases), demonstrate offshore project execution capabilities valuable for renewable energy projects, and maintain workforce continuity during the energy transition enabling skills transfer into clean energy sectors.

Opportunity #5: Floating Offshore Wind—A Scottish-Led Technology Frontier

Market Scale and Timeline

Floating offshore wind is projected to reach 2.5 GW operational globally by end-2025 and expand to approximately 16.5 GW by 2030, with Scotland positioned as the global epicenter of technology development and deployment. The 221 GW global floating pipeline includes substantial Scottish projects: Green Volt (560 MW, first commercial-scale floating farm), Salamander (100 MW INTOG innovation project consented in July 2025), and multiple ScotWind floating developments in deep-water Atlantic sites.

Scotland's competitive advantages in floating wind are structural: extensive deepwater sites with excellent wind resources (Atlantic exposure, Moray Firth approaches), established oil and gas expertise in floating structures and mooring systems, purpose-built port infrastructure (Cromarty Firth £55M investment, Kishorn £24.3M upgrade, Nigg Inner East Quay, Ardersier Energy Transition Facility), and supportive policy frameworks through INTOG and ScotWind with explicit innovation focus.

Specific Opportunities for North East Scotland SMEs

- **Floating foundation fabrication:** Semi-submersible concrete or steel foundation fabrication, spar-buoy construction, tension-leg platform manufacturing, and integration of turbine and foundation at quayside.
- **Mooring system design and supply:** Synthetic rope and chain mooring systems, drag-embedment and suction-pile anchor design and fabrication, dynamic cable integration with mooring systems, and installation and tension monitoring systems.
- **Marine installation services:** Towing and positioning of floating foundations, anchor installation (specialist vessels and ROV), dynamic cable installation and connection, and commissioning support for floating arrays.
- **Port and quayside integration:** Wet storage facilities for completed foundations, integration quays for turbine mounting onto foundations, load-out and sea fastening services, and marshalling areas for components.
- **Operations and maintenance:** Floating-specific maintenance platforms and techniques, dynamic cable inspection and repair, mooring inspection and tensioning services, and predictive maintenance systems for floating dynamics.
- **Technology development:** Floating wind innovation projects (sensors, monitoring, control systems), digital twin development for floating performance optimization, and demonstration project support services.

Competitive Advantages

Scotland's floating wind advantage is multifaceted: oil and gas sector experience with floating production platforms and mooring systems provides direct technology transfer, coastal locations with Atlantic exposure enable testing in realistic operating conditions before export to international markets, substantial public funding (FLOWMIS, INTOG innovation support, Scottish Government port investment) de-risks early commercial projects, and first-mover positioning as the global floating wind testbed creates export opportunities as other markets mature.

The convergence of floating wind and hydrogen creates additional opportunities: offshore hydrogen production platforms utilizing floating wind power represent a logical extension of Scotland's capabilities, with potential applications in remote locations (Atlantic islands, Southeast Asian archipelagos) where grid connection is challenging. Companies developing integrated floating wind-hydrogen expertise will access premium markets as this technology pathway matures through the late 2020s-2030s.

Opportunity #6: International Market Export—Southeast Asia, Europe, Global South

Market Scale and Geographic Focus

Southeast Asia represents the highest-growth offshore low carbon energy market globally, with Vietnam targeting 6 GW offshore wind by 2030 and 17 GW by 2035, the Philippines awarding 3.3 GW in its first auction, and Indonesia, Malaysia, and Thailand advancing regulatory frameworks and pilot projects. Combined ASEAN offshore wind potential exceeds 100 GW, with the ASEAN Power Grid targeting 18 GW of interconnector capacity by 2040 enabling cross-border renewable energy trading.

Regional infrastructure deficits create substantial supply chain opportunities: limited domestic offshore wind experience, insufficient port infrastructure for large-scale offshore construction, scarce specialized installation vessel capacity, and gaps in subsea cable manufacturing and grid integration expertise. These deficits favor international contractors—particularly those from mature offshore energy regions like North East Scotland—who can provide turnkey services, training, and technology transfer.

Specific Market Entry Strategies

Vietnam—Near-Term Priority Market

Vietnam's offshore wind regulatory framework advanced substantially in 2025, with charter capital requirements ($379M per developer), equity commitments (15% of project investment), PPA guarantees (90% of output), and seabed-use fee waivers creating actionable investment mechanisms. Minister of Industry and Trade Nguyen Hong Dien emphasized Vietnam's immediate need for offshore wind survey data, port infrastructure development, and engineering expertise—gaps North East Scotland companies can address.

Entry strategies for Vietnam include: establishing regional offices in Ho Chi Minh City or Hai Phong by 2026 to monitor permit pipeline and developer engagement; partnering with Vietnamese engineering firms (Delta TC, Wupeco) for local market knowledge and regulatory navigation; positioning for FEED contracts (2026-2027) offering highest margins before EPC competition intensifies; and building relationships with international developers active in Vietnam (Copenhagen Infrastructure Partners, PNE AG, GE Vernova).

The Philippines—First-Mover Advantage

The Philippines' successful first offshore wind auction (November 2025, 3.3 GW awarded) with clear grid connection plans and port strategies demonstrates regulatory momentum and creates immediate opportunities for baseline survey campaigns, port infrastructure scoping and development, developer advisory on regulatory compliance and project structuring, and grid integration studies for subsea cable routing.

ACEN-Copenhagen Infrastructure Partners' 1 GW partnership in Camarines Sur and Mingyang Smart Energy's 2 GW northern Philippines project represent anchor clients for supply chain services, with procurement timelines aligning with 2027-2030 construction phases.

Poland and Baltic Sea—European Export Adjacent

Poland's BC-Wind achieving financial close (€2 billion, 390 MW) validates the Baltic Sea as Europe's next major offshore wind theater, with Polish ports (Świnoujście, Gdańsk) serving as marshalling harbors creating logistics and fabrication opportunities. The Baltic's emergence parallels North Sea development 15-20 years prior, suggesting sustained multi-decade growth trajectory with strong local content requirements favoring early-mover European suppliers.

Competitive Positioning for Export Markets

North East Scotland SMEs possess specific competitive advantages in emerging international markets: deep offshore expertise establishing credibility with developers and international lenders; English language and UK regulatory standards (widely referenced internationally) facilitating knowledge transfer; willingness to invest in training and capacity building (creating goodwill and long-term relationships); and geographic positioning enabling responsive international support.

The Scottish Government's export support mechanisms—Scottish Development International, Scottish Enterprise international offices, and sector-specific trade missions—provide infrastructure for market entry, though companies must commit resources to relationship building and demonstration project delivery to establish local presence.

Capability Development Priorities: Closing the Gap

Critical Capability Gaps Requiring Investment

North East Scotland SMEs possess world-class offshore oil and gas engineering capabilities but face specific gaps when transitioning to offshore low carbon energy markets. Addressing these gaps through targeted investment, training partnerships, and strategic hires is essential for competitive positioning.

High-Voltage Electrical Engineering

Offshore wind projects require extensive high-voltage electrical expertise: 66kV and 132kV array cable systems, offshore substation design (33/132kV and 132/220kV transformers), HVDC converter platforms

for long-distance export, grid integration and power quality management, and protection systems and fault ride-through capabilities. This represents a fundamental departure from oil and gas projects' typical 11kV-33kV distribution systems.

North East Scotland has limited domestic HV engineering capacity relative to market demand, creating dependency on Central Belt or international specialists. Companies should invest in: partnerships with HV equipment suppliers (Siemens Energy, ABB, GE Grid Solutions) to access technical expertise and reference designs; training existing electrical engineers in HV standards (IEC, IEEE) and grid codes; recruiting experienced HV engineers from power sector backgrounds; and establishing R&D collaborations with universities (Strathclyde, Aberdeen) on offshore electrical systems.

Floating Wind Mooring and Anchoring Systems

While North East Scotland has extensive mooring experience from floating production platforms, offshore wind mooring systems present distinct challenges: synthetic rope mooring requiring different installation techniques, permanent mooring design for 25+ year life (vs. temporary oil/gas moorings), dynamic cable integration with mooring systems, and compliance with floating wind-specific standards (DNV, IEC).

Capability development should include: partnerships with specialist mooring suppliers (Vryhof, STEVSHARK, Balltec), training in synthetic rope handling and installation, investment in mooring analysis software (OrcaFlex, ANSYS AQWA), and demonstration projects on INTOG innovation sites to establish track records.

Hydrogen Systems Engineering

Hydrogen infrastructure requires specialized capabilities beyond conventional oil and gas process engineering: high-pressure hydrogen pipeline materials (avoiding hydrogen embrittlement), electrolyzer balance-of-plant systems (water treatment, thermal management), hydrogen compression (reciprocating vs. centrifugal options), storage systems (underground caverns, pressure vessels), and safety systems specific to hydrogen (leak detection, flame detection, explosion protection).

Companies transitioning to hydrogen should pursue: safety training (HSE hydrogen safety, ATEX for hydrogen environments); materials engineering courses on hydrogen compatibility; partnerships with electrolyzer OEMs (ITM Power, NEL Hydrogen, Plug Power) for balance-of-plant opportunities; and involvement in demonstration projects (Aberdeen Hydrogen Hub, St Fergus developments) to build practical experience.

Carbon Capture Engineering

CCUS projects demand specific process engineering capabilities: CO_2 capture technologies (post-combustion, pre-combustion, oxy-fuel), CO_2 compression and conditioning (removing impurities, achieving pipeline specifications), CO_2 transport systems (high-pressure pipeline design, corrosion management), reservoir engineering for storage site characterization, and monitoring, verification, and accounting (MVA) systems.

North East Scotland's reservoir and well engineering expertise from oil and gas provides strong foundations, but companies should supplement with: training in CO_2-specific corrosion and materials science; reservoir simulation for CO_2 injection and plume modeling; partnerships with capture technology providers (Shell Cansolv, Aker Carbon Capture, Mitsubishi Heavy Industries); and participation in Acorn CCUS development studies and supply chain forums.

Digital Technologies and Data Analytics

Offshore wind, hydrogen, and CCUS projects increasingly rely on digital systems: SCADA systems for wind farm monitoring and control, predictive maintenance using machine learning and AI, digital twins for performance optimization and asset management, energy forecasting and grid integration algorithms, and cybersecurity for operational technology environments.

Traditional oil and gas companies often lag in digital capabilities compared to pure-play technology firms. Addressing this requires: hiring data scientists and software engineers with energy sector interest; investing in analytics platforms (Python, R, Tableau, Power BI for energy applications); partnering with digital technology firms (Akselos, Shoreline, Ping Services) on co-development projects; and participating in Offshore Renewable Energy Catapult digital innovation programs.

Workforce Development and Skills Transition

Transferable Skills from Oil and Gas

North East Scotland's 40+ year oil and gas heritage created a workforce with extensive transferable skills: offshore operations and marine coordination, subsea engineering and installation, project management and controls, welding and NDT inspection, crane operations and heavy-lift, HSE leadership and regulatory compliance, and supply chain and logistics management.

Studies indicate approximately 66% of oil and gas roles possess core skills transferable to renewable energy sectors, with offshore wind, hydrogen, and CCUS showing particularly strong overlap. Companies should conduct systematic skills mapping exercises identifying which current employees can transition to

clean energy roles with modest retraining (weeks to months) versus those requiring extensive reskilling (6-12+ months).

Training Infrastructure and Support

Scotland's energy transition training ecosystem provides substantial support for workforce development:

- **Energy Skills Passport:** Maps mutually recognized qualifications across sectors, avoiding training duplication while charting career pathways from oil/gas into offshore wind, hydrogen, and CCUS.
- **Oil and Gas Transition Training Fund:** £900,000 UK Government funding providing current or former oil/gas workers in Aberdeen City and Aberdeenshire access to industry-recognized training for offshore wind and related sectors.
- **Global Wind Organisation (GWO) Training:** Expanded facilities throughout Scotland delivering mandatory safety courses for wind turbine work (Basic Safety Training, Basic Technical Training, Advanced Rescue Training).
- **OPITO Energy Transition Programme:** Leading cross-industry skills alliance developing an all-energy workforce through modular training and competency frameworks.
- **SOWEC Skills Guide:** Comprehensive resource profiling 85 key offshore wind job roles, entry routes, and critical skills gaps, developed with Skills Development Scotland.

Companies should leverage these resources strategically: conduct batch training for teams transitioning from oil/gas to offshore wind/hydrogen projects; require GWO certification for offshore personnel before pursuing wind farm O&M contracts; participate in industry skills alliances (OPITO, SOWEC Skills Group) to influence curriculum development and access emerging talent; and establish graduate apprenticeship partnerships with universities and colleges to create talent pipelines.

Retention and Recruitment Challenges

The energy transition creates talent competition across sectors, with offshore wind, hydrogen, CCUS, and traditional oil/gas all competing for experienced engineers, project managers, and offshore technicians. Companies face risks of losing key personnel to higher-paying roles in competing sectors or to international opportunities.

Retention strategies should include: clear career pathways showing progression opportunities in clean energy roles; investment in training and certification (GWO, HV qualifications, hydrogen safety) as employee value proposition; flexible working arrangements balancing offshore rotations with remote work; and competitive compensation reflecting renewable energy sector salary levels (typically 10-20% premium for scarce skills).

Recruitment requires targeting non-traditional talent pools: recent engineering graduates from renewables-focused programs; mid-career professionals from power sector backgrounds (utilities, grid operators); international talent from mature offshore wind markets (Denmark, Netherlands, Taiwan); and career changers from adjacent industries (shipbuilding, aerospace, automotive) seeking energy transition opportunities.

Business Model Evolution: From Project Services to Integrated Solutions

The Limitations of Traditional Subcontracting

North East Scotland oil and gas supply chains historically operated on project-based subcontracting models: operators (Shell, BP, TotalEnergies) defined scopes, awarded contracts to tier-1 engineering firms (Technip, Subsea 7, Aker Solutions), who subcontracted fabrication and installation to regional SMEs.

This model provided sustained revenue but limited margins, created dependency on tier-1 procurement cycles, offered minimal direct client relationships, and provided little control over project timelines and scopes.

Offshore wind, hydrogen, and CCUS markets present opportunities for alternative business models that capture greater value, reduce dependency on single clients, and enable differentiation based on integrated capabilities rather than lowest-cost execution.

Integrated Service Provider Model

Companies offering integrated, multi-discipline services spanning design through commissioning can command premium margins and direct developer relationships. Examples include:

- **Platform Conversion Specialist:** Combining reservoir engineering (storage site assessment) + subsea engineering (wellhead modification) + project management (repurposing campaigns) + operations support (injection monitoring) = turnkey platform-to-storage conversion, reducing developer coordination burden and creating single-point accountability.
- **Offshore Wind Balance-of-Plant Integrator:** Offering foundation design + fabrication + installation + commissioning as integrated package, reducing interface risks between separate contractors and enabling optimization across the supply chain.
- **Hydrogen Infrastructure Developer:** Providing FEED studies + pipeline engineering + compression systems + storage facilities as integrated hydrogen transmission solution, particularly for smaller industrial offtakers lacking in-house engineering.

This model requires: investment in multi-discipline teams combining traditionally separate functions (civil, electrical, mechanical, process engineering); project management capabilities coordinating internal delivery across disciplines; risk management and insurance frameworks appropriate for integrated contracts; and relationships with equipment suppliers and technology providers enabling equipment procurement.

Joint Venture and Consortium Models

For large-scale opportunities beyond individual SME capacity, joint ventures and consortia enable capability aggregation, risk sharing, and competitive positioning. Successful approaches include:

- **Geographic Consortia:** North East Scotland SMEs partnering with Southeast Asian engineering firms to deliver integrated services in Vietnam/Philippines markets, combining Scottish offshore expertise with local regulatory knowledge and client relationships.
- **Technology Consortia:** Fabrication specialist + installation contractor + digital technology provider forming consortium to deliver offshore wind foundations with integrated monitoring systems, offering differentiated value proposition beyond commodity fabrication.
- **Supply Chain Alliances:** Multiple SMEs covering complementary scopes (cables, foundations, installation, commissioning) forming standing alliances that can respond to large tenders requiring integrated solutions.

Critical success factors include: clearly defined governance and decision-making structures; explicit IP ownership and technology sharing agreements; transparent cost allocation and profit distribution mechanisms; and exit provisions if partnerships underperform or strategic priorities diverge.

Product Development and IP Creation

Transitioning from pure services to products and intellectual property enables recurring revenue, higher margins, and reduced project cycle dependency. Opportunities include:

- **Proprietary Equipment:** Developing specialized tools or equipment for offshore wind installation, hydrogen monitoring systems, or CCUS well intervention, then licensing or selling to operators and contractors.
- **Software and Digital Solutions:** Creating predictive maintenance algorithms, digital twin platforms, or energy optimization software for offshore wind farms or hydrogen facilities, selling as SaaS (Software as a Service) subscriptions.
- **Process IP:** Patenting innovative methods for mooring installation, platform conversion, or hydrogen compression, licensing to international contractors or using as competitive differentiator in tenders.

This model requires: R&D investment in technology development (typically 5-10% of revenue); partnerships with universities or research institutions for IP co-development; patent filing and IP protection strategies; and sales and marketing capabilities for commercializing products beyond traditional project delivery.

Partnership Strategies: Navigating the Value Chain

Tier-1 Contractor Relationships

Major international contractors (Subsea 7, Aker Solutions, Technip Energies, Saipem, McDermott) execute large offshore wind, hydrogen, and CCUS projects and represent primary route-to-market for North East Scotland SMEs. Effective engagement requires:

- **Strategic Account Management:** Assign dedicated relationship managers to key tier-1 accounts, maintain regular engagement beyond active projects, understand their strategic priorities and project pipelines, and align capability development with their anticipated needs.
- **Preferred Supplier Status:** Pursue formal preferred supplier agreements offering volume commitments in exchange for pricing certainty, guaranteed response times, and quality assurance, reducing transaction costs for repeat business.
- **Early Engagement:** Participate in FEED studies and pre-FID engineering, influencing scope definitions and design approaches that favor your capabilities, creating competitive advantages when projects reach construction.
- **Performance Differentiation:** Maintain impeccable HSE records (zero LTIs, strong safety culture), deliver consistently on schedule and budget, and proactively communicate risks and mitigation strategies, establishing reputation for reliability that commands pricing premiums.

Developer Direct Relationships

Where feasible, building direct relationships with project developers (SSE Renewables, Ocean Winds, Ørsted, Equinor, Vattenfall) reduces dependency on tier-1 intermediaries and enables earlier project involvement. Strategies include:

- **Capability Demonstrations:** Secure small demonstration contracts or innovation projects (INTOG, ORE Catapult programs) proving capabilities directly to developers, creating track records independent of tier-1 relationships.
- **Technical Advisory Roles:** Offer independent technical advisory services during developer FEED phases, providing specialized expertise (floating mooring, hydrogen integration, CCUS site assessment) establishing credibility for subsequent construction contracts.

- **Local Content Commitments:** Position as preferred partner for developers meeting UK Government Clean Industry Bonus or local content requirements, offering Scottish-based facilities and workforce as competitive differentiator.
- **Long-Term O&M Contracts:** Target operations and maintenance contracts providing 20-25 year revenue visibility, building developer relationships during construction that continue into operational phases.

Technology Partner Relationships

Partnerships with technology OEMs (turbine manufacturers, electrolyzer suppliers, capture technology providers) enable access to proprietary designs, training, and preferred supplier status for balance-of-plant work. Approaches include:

- **Authorized Service Providers:** Become certified service partners for major turbine OEMs (Vestas, Siemens Gamesa, GE Vernova), accessing training, spare parts supply, and referrals for maintenance contracts in your region.
- **Balance-of-Plant Partners:** Partner with electrolyzer manufacturers (ITM Power, NEL Hydrogen, Plug Power) as preferred suppliers for water treatment, electrical integration, and civil works, receiving leads for projects using their equipment.
- **Co-Development Agreements:** Collaborate with technology companies on novel solutions (floating wind innovations, offshore hydrogen platforms, CCUS monitoring systems), sharing development costs and IP ownership, accessing innovation funding together.

Financial Partner Relationships

Large offshore projects require substantial capital for equipment procurement, working capital during construction, and performance bond capacity. Financial partnerships enable competitiveness for larger contracts:

- **Project Finance Relationships:** Establish relationships with infrastructure funds, pension funds, and development banks (EIB, Green Investment Bank, Scottish National Investment Bank) willing to co-invest in large contracts or joint venture projects.
- **Equipment Finance:** Secure pre-approved equipment financing lines enabling rapid procurement for time-sensitive projects without straining balance sheets.
- **Export Credit Agencies:** For international projects, engage UK Export Finance, Euler Hermes, or Asian Development Bank trade finance programs de-risking emerging market contracts.

Risk Management and Mitigation Strategies

Market and Policy Risks

Oil and Gas Dependency Risk

Companies deriving >50% revenue from oil and gas face existential risk as UK production declines, operators divest, and the 78% windfall tax suppresses investment. Mitigation requires: setting explicit clean energy revenue targets (e.g., 50% of revenue from offshore wind/hydrogen/CCUS by 2030); allocating dedicated business development resources to renewable sectors; and accepting short-term margin compression on renewable projects to build track records and market position.

Policy Volatility Risk

Government policy changes can disrupt market trajectories, as demonstrated by the Trump administration's offshore wind reversals in the US. Diversification across multiple geographies (UK, EU, Southeast Asia) and technologies (wind, hydrogen, CCUS) reduces exposure to single-policy risks. Companies should monitor policy indicators (election cycles, government consultations, budget announcements) and maintain flexibility to reallocate resources toward stable markets.

Technology Risk

Backing emerging technologies (floating wind, green hydrogen, DAC) before commercial viability is proven creates stranded investment risk. Mitigation includes: portfolio approach investing in multiple technology pathways rather than single bets; following (not leading) technology adoption curves by entering markets once anchor projects reach FID; and partnering with well-capitalized technology companies able to absorb development costs.

Operational and Execution Risks

Skills Shortage Risk

Critical skills gaps in HV engineering, offshore installation, and hydrogen systems threaten project delivery. Proactive mitigation includes: early recruitment campaigns before project awards; partnerships with training providers securing batch training slots; retention programs preventing key staff departures; and subcontracting with specialist firms for scarce capabilities rather than attempting all work in-house.

Supply Chain Risk

Global shortages of cables, turbines, installation vessels, and specialized equipment can delay projects and trigger contractual penalties. Risk management requires: early equipment reservation with suppliers even before contract awards; alternative supplier qualification providing backup options; and contractual

provisions with clients allocating supply chain delay risks appropriately (force majeure, excusable delays).

Installation Weather Risk

Offshore operations face weather windows, particularly in harsh North Atlantic and North Sea environments. Conservative weather planning (using 90th percentile weather data), contingency vessel availability, and contractual weather delay provisions reduce exposure. Companies should invest in weather forecasting tools and maintain flexible workforce pools enabling rapid mobilization when weather windows open.

Financial and Contractual Risks

Fixed-Price Contract Risk

Offshore wind and hydrogen projects increasingly use fixed-price EPC or EPCI contracts transferring cost risk to contractors. SMEs should: conduct rigorous cost estimation using historical data and contingency analysis; include escalation clauses for steel, copper, and other commodity inputs; and negotiate payment milestones front-loading cash flows to reduce working capital requirements.

Currency Risk

International projects (Southeast Asia, European export markets) expose companies to currency fluctuations. Hedging strategies include: natural hedges (matching revenue currency with cost currency through local procurement); forward contracts or options for large, long-duration contracts; and passing currency risk to clients via pricing in multiple currencies or periodic adjustment mechanisms.

Client Credit Risk

Emerging market projects and novel technology developers may present client credit risks. Due diligence on client financial strength, parent company guarantees or letters of credit securing payment, and project finance structures with ring-fenced accounts reduce exposure. Companies should prioritize established developers and tier-1 contractors for initial clean energy market entry before pursuing higher-risk, higher-margin opportunities.

Strategic Roadmap: A Phased Approach for SMEs

Phase 1 (2025-2027): Foundation Building and Market Entry

Strategic Objectives:

- Reduce oil and gas revenue dependency from current levels to ≤60% of total revenue

- Secure first offshore wind, hydrogen, or CCUS contract demonstrating capability transition
- Complete capability gap analysis and initiate critical training programs
- Establish partnerships with at least two tier-1 contractors or developers in renewable sectors

Priority Actions:

Immediate (Q1-Q2 2026):

- Conduct comprehensive capability assessment mapping existing competencies against offshore wind, hydrogen, and CCUS requirements, identifying transferable skills and critical gaps
- Assign executive sponsor for energy transition with P&L responsibility for clean energy business development
- Join relevant industry associations (SOWEC, Scottish Renewables, Hydrogen Scotland, CCUS Scotland) gaining market intelligence and networking access
- Initiate contact with 5-10 target tier-1 contractors or developers, scheduling capability presentation meetings
- Enroll critical personnel in GWO Basic Safety Training and sector-specific courses (offshore wind, hydrogen safety)

Near-Term (Q3 2026-Q4 2027):

- Bid aggressively on 3-5 demonstration projects or small-scale contracts accepting lower margins to establish track records
- Complete capability development investments in 1-2 priority technology areas (e.g., floating wind mooring systems, hydrogen pipeline engineering)
- Achieve preferred supplier status with at least one major tier-1 contractor
- Attend major industry events (Floating Offshore Wind Scotland, World Hydrogen Expo, CCUS conferences) exhibiting capabilities and conducting business development
- Establish KPIs tracking energy transition progress: clean energy revenue percentage, pipeline value in renewable sectors, workforce trained in GWO/hydrogen/CCUS, and client satisfaction in new sectors

Phase 2 (2028-2030): Scale and Diversification

Strategic Objectives:

- Achieve 50%+ revenue from offshore wind, hydrogen, and CCUS sectors

- Expand internationally with contracts or partnerships in at least one export market (Southeast Asia, Europe)
- Transition from pure subcontracting to integrated service provider model capturing higher margins
- Develop proprietary IP or products creating recurring revenue streams

Priority Actions:

Market Expansion:

- Establish regional office or partnership in target export market (Vietnam, Poland, or Indonesia) with dedicated business development presence
- Secure first international contract demonstrating export capability, leveraging UK Export Finance or development bank support for de-risking
- Develop case studies and marketing collateral showcasing successful offshore wind/ hydrogen/ CCUS project delivery for international positioning

Business Model Evolution:

- Launch integrated service offering combining 2-3 complementary capabilities (e.g., platform conversion = reservoir engineering + subsea modification + project management)
- Form strategic joint venture or consortium with complementary firms enabling pursuit of larger, higher-value contracts
- Invest in R&D (target 5-7% of revenue) developing proprietary technology, methods, or software for offshore clean energy applications

Operational Excellence:

- Achieve HSE performance metrics competitive with tier-1 contractors (zero LTIs, <1.0 TRCF) establishing reputation for safety excellence
- Implement digital project management and cost control systems enabling fixed-price contract competitiveness[35]
- Obtain relevant certifications (ISO 9001, ISO 14001, ISO 45001, ISO 50001) required for major project tenders

Phase 3 (2031-2035): Leadership and Optimization

Strategic Objectives:

- Establish position as recognized specialist in 1-2 offshore clean energy niches (floating wind, hydrogen infrastructure, platform conversion, etc.)

- Achieve 70%+ revenue from clean energy with oil and gas as legacy/declining segment
- Generate recurring revenue from IP licensing, product sales, or long-term O&M contracts
- Influence industry standards and policy through thought leadership and association participation

Priority Actions:

Market Leadership:

- Pursue direct developer relationships reducing tier-1 contractor dependency through track record and reputation
- Expand internationally to 2-3 additional export markets leveraging demonstrated capability from Phase 2 international entry
- Consider strategic acquisitions of complementary capabilities or geographic presence accelerating growth beyond organic trajectory

Innovation and Differentiation:

- Commercialize proprietary technology developed in Phase 2, generating licensing revenue or product sales independent of project cycles
- Establish innovation partnerships with universities (Aberdeen, Strathclyde, Edinburgh) accessing research funding and graduate talent
- Publish technical papers, present at conferences, and participate in industry working groups establishing thought leadership positioning

Workforce and Culture:

- Achieve workforce composition with 70%+ personnel trained and certified in offshore wind/hydrogen/CCUS disciplines
- Develop internal training academies or partnerships enabling continuous upskilling as technologies evolve
- Establish employer brand as premier clean energy employer in North East Scotland attracting top talent from competing firms and new graduates

Policy Advocacy and Industry Collaboration

Collective Action Through Industry Associations

Individual SMEs have limited influence over policy and regulation, but collective action through industry bodies amplifies voice and shapes frameworks benefiting the sector. North East Scotland companies should engage actively with:

- **Scottish Offshore Wind Energy Council (SOWEC):** Influencing Scottish Government offshore wind policy, supply chain development programs, and port infrastructure investment priorities. SMEs should participate in working groups (skills, supply chain, innovation) and contribute to policy consultations.
- **Energy Transition Zone Aberdeen:** Shaping the £180 million Energy Transition Zone's development, ensuring infrastructure meets SME needs for fabrication space, testing facilities, and collaboration areas.
- **Scottish Renewables and RenewableUK:** Engaging UK-wide policy advocacy on CfD mechanisms, local content requirements, permitting reform, and grid connection processes.
- **Hydrogen Scotland and CCUS Scotland:** Participating in hydrogen and CCUS policy development, funding allocation decisions, and cluster formation activities.

Priority Policy Advocacy Objectives

Local Content and Supply Chain Support:

Advocate for strengthened local content requirements in CfD contracts and Crown Estate lease agreements, ensuring UK and Scottish suppliers receive fair opportunity to compete against international suppliers. Support Clean Industry Bonus mechanisms that reward domestic content but oppose protectionism that increases project costs unsustainably.

Skills and Training Investment:

Press Scottish and UK governments for sustained funding of workforce transition programs (Oil & Gas Transition Training Fund, Energy Skills Passport, GWO training facilities), arguing that skills gaps threaten offshore wind deployment targets and economic benefits realization.

Regulatory Efficiency:

Support efforts to streamline permitting and consenting processes while maintaining environmental standards, advocating for "go-to areas" approaches, coordinated environmental assessments, and early developer-regulator engagement reducing approval timelines.

Export Support:

Encourage Scottish Development International and UK Department for Business and Trade to prioritize energy transition export missions, provide market intelligence on Southeast Asian opportunities, and facilitate business-to-business introductions with international developers.

Innovation Funding:

Advocate for continued Offshore Wind Accelerator, Hydrogen Accelerator, and CCUS innovation funding programs enabling SMEs to de-risk technology development through cost-shared R&D projects.

Conclusion: A Defining Decade for North East Scotland

The global offshore low carbon energy sector's transformation in 2025 presents North East Scotland energy supply chain SMEs with a once-in-a-generation opportunity to secure long-term prosperity through decisive capability transition, strategic positioning, and sustained execution excellence. The convergence of 19.6 GW offshore wind deployment, €240 billion European hydrogen infrastructure investment, £9.4 billion UK CCUS commitment, and £2+ billion annual decommissioning expenditure creates a structured, decade-long pipeline of commercial opportunities exceeding the scale of North Sea oil and gas at its peak.

Success requires acknowledging hard truths: oil and gas will continue declining regardless of individual company preferences, Asian competitors possess cost advantages in commodity manufacturing, policy volatility remains a persistent risk requiring geographic diversification, and capability gaps demand investment before returns materialize. Companies clinging to legacy business models, deferring transition investments, or hoping for oil and gas recovery face existential risks as the energy transition accelerates through the 2030s.

The path forward is clear: conduct honest capability assessments identifying transferable strengths and critical gaps; invest aggressively in workforce training, technology partnerships, and demonstration projects establishing clean energy track records; pursue integrated service models capturing higher value than pure subcontracting; diversify geographically across UK, European, and Southeast Asian markets; and engage collectively through industry associations to shape policies supporting domestic supply chains.

North East Scotland possesses inherent competitive advantages—world-class offshore expertise, established infrastructure, skilled workforce, and proximity to major projects—that position the region as a natural beneficiary of the energy transition. These advantages are not permanent; Asian manufacturers, European competitors, and new market entrants are investing aggressively to capture the same

opportunities. The window for leveraging North Sea heritage to establish clean energy leadership is open now, but it will narrow substantially by 2030 as supply chains consolidate and market positions solidify.

The companies that thrive through 2035 and beyond will be those that act decisively in 2025-2027, transitioning from oil and gas dependency to clean energy leadership while global markets remain fluid and early-mover advantages are available. For North East Scotland SMEs, this is not merely a commercial opportunity—it is an imperative for long-term survival and prosperity in the net-zero economy.

References

1. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/32f163a4-b3dd-4077-844b-5363c8f0bb10/Energy-Transition-Weekly-Vol-1-No-2-12th-Dec-2025.pdf

2. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/78ad152a-b5cf-4129-9888-2658dea97632/Energy-Transition-Weekly-Global-Edition-Vol-1-No-1.pdf

3. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/e1247098-192e-4b32-aebc-9037c6887522/Energy_Transition_Weekly_Vol1_No1.pdf

4. https://www.rystadenergy.com/news/global-offshore-wind-landmark-19gw

5. https://www.offshorewindscotland.org.uk

6. https://www.offshorewindscotland.org.uk/media/11940/strategic-investment-assessment-report-august-2021.pdf

7. https://www.offshorewindscotland.org.uk/news/2025/february/25/how-innovation-drives-offshore-wind-supply-chain-growth/

8. https://eurometal.net/global-hydrogen-investment-to-jump-70-in-2025-despite-project-delays/

9. https://www.soci.org/news/2025/5/ccus-carbon-capture-is-growing-but-there-is-still-much-to-do

10. https://www.iigcc.org/insights/world-energy-investment-2025-highlights-electricity-demand-and-energy-security-new-drivers

11. https://www.renewableuk.com/news-and-resources/press-releases/global-operational-offshore-wind-capacity-up-14-in-last-12-months-to-85-gigawatts/

12. https://theextractormagazine.com/2025/10/24/over-1500-green-hydrogen-projects-announced-across-70-countries/

13. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/475f3b25-f26f-4daa-ab59-1de3a081fa3a/Energy-Transition-Weekly-ASEAN-Vol1-No1.pdf

14. https://www.renewableuk.com/energypulse/reports/global-offshore-wind-pipeline-june-2025/

15. https://www.nortonrosefulbright.com/en/knowledge/publications/1a59df58/the-next-frontier-offshore-wind-development-in-asia

16. https://www.offshorewindscotland.org.uk/news/2024/april/17/uk-offshore-wind-industrial-growth-plan-published/

17. https://www.thecrownestate.co.uk/our-business/marine/round-5

18. https://www.offshorewindscotland.org.uk/news/2025/march/6/port-of-cromarty-firth-secures-55m-flowmis-funding/

19. https://www.offshorewindscotland.org.uk/news/2025/june/4/multi-million-investment-for-floating-wind-at-kishorn-port/

20. https://www.offshorewindscotland.org.uk/news/2025/october/27/buchan-offshore-wind-submits-onshore-consent-application/

21. https://www.renewableuk.com/energypulse/reports/floating-offshore-wind-pipeline-report-november-2025/

22. https://www.offshorewindscotland.org.uk/news/2024/january/11/10-000-offshore-wind-jobs-in-scotland/

23. https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/intog-leasing-round/

24. https://www.startus-insights.com/innovators-guide/hydrogen-economy-outlook/

25. https://www.offshorewindscotland.org.uk/media/12632/repurposing-oil-and-gas-infrastructure-report.pdf

26. https://www.airswift.com/blog/top-transferrable-skills-in-energy

27. https://www.woodmac.com/news/opinion/the-forces-shaping-the-future-of-carbon-management/

28. https://cib.bnpparibas/the-future-of-carbon-capture-and-storage-strategies-and-challenges/

29. https://ieaghg.org/news/delivering-the-next-phase-of-ccus-key-takeaways-from-day-one-of-the-ccus-2025-conference/

30. https://www.renewableuk.com/news-and-resources/press-releases/report-shows-13-increase-in-floating-offshore-wind-capacity-worldwide/

31. https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/floating-wind-in-scotland/

32. https://www.offshorewindscotland.org.uk/news/2025/july/24/salamander-floating-wind-project-consented-by-scottish-ministers/

33. https://www.offshorewindscotland.org.uk/media/r3rp3du2/sowec-innovation-guide-january-2025.pdf

34. https://www.offshore-windindustry.com/news/wind/article-6912-offshore-wind-expansion-in-taiwan-gains-momentum-peak-wind-secures-operational-management-for-495-mw-fengmiao-i-wind-farm

35. https://www.astutepeople.co.uk/blog/2025/07/17/top-10-skills-for-uk-renewable-energy-jobs-in-2025/

36. https://www.imperial.ac.uk/energy-futures-lab/reports/briefing-papers/net-zero-skills--jobs-skills-and-training-for-the-net-zero-energy-transition/

37. https://www.key-expo.com/en/news-detail/jobs-in-the-energy-transition?newsId=6237480

38. https://www.offshorewindscotland.org.uk/skills-for-offshore-wind/transition-pathway/transition-support/

39. https://www.skillsdevelopmentscotland.co.uk/news-events/2025/july/oil-and-gas-transition-training-fund-offers-pathway-to-clean-energy-jobs/

40. https://www.offshorewindscotland.org.uk/the-scottish-offshore-wind-industry/sowec/sowec-publications/sowec-skills-guide/

41. https://www.offshorewindscotland.org.uk/media/v3hbtyv3/sowec-skills-guide-february-2025.pdf

42. https://www.guiceoffshore.com/offshore-wind-supply-chain-roadmap-development-next-step-for-federal-state-offshore-wind-implementation-partnership/

43. https://www.offshorewindscotland.org.uk/news/2025/april/24/prime-minister-launches-300m-boost-for-offshore-wind-industry/

44. https://www.offshorewindscotland.org.uk/news/2025/november/10/owgp-launch-industrial-growth-fund/

45. https://www.offshorewindscotland.org.uk/news/2025/january/15/sowec-welcomes-20-million-investment-in-xlcc-by-the-scottish-national-investment-bank/

46. https://www.renewableenergyworld.com/wind-power/offshore/us-offshore-wind-long-dead-now-really-dead/

47. https://www.neuwave.co.uk/2025/06/03/policy-changes-and-impacts-on-offshore-wind-developments-in-2025/

48. https://www.waveenergyscotland.co.uk/news/2025/june/uk-government-launches-marine-energy-taskforce-to-accelerate-wave-and-tidal-innovation/

49. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/398e30d2-f844-48e8-963e-4cd5903c59b2/Unlocking-ASEAN-Low-Carbon-Market-Opportunities-Final-Version.pdf

50. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/634fbecc-d30d-46f2-aa63-d7f1492645df/Offshore-Low-Carbon-Market-Opportunities-in-Vietnam.pdf

51. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/fab70d6e-1233-435a-89a9-57bfbc8291cb/Offshore-Low-Carbon-Energy-Projects-Contracts-in-Vietnam.pdf

52. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/0ee61136-806b-4ba5-8ef7-64a09b7841db/Low-Carbon-Market-Opportunities-in-the-ASEAN-Region.pdf

53. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/a4b9a0e7-4d32-4bc7-a5c0-2bd93113c0fc/ASEAN-Low-Carbon-Energy-Projects-Contracts.pdf

54. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/f8c606c2-a53b-4f8a-8535-dc11470734d1/please-provide-a-list-of-the-m-Y7qVduLaS5WymLhQJWDO.w.md

55. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/85a449c3-f1bb-48ca-926f-7f88312b9595/Market-Intelligence-Opportunity-Identification_-1.docx

56. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/309b50e3-85e8-4b6d-9807-4c991c56bd7f/TOOLKIT-2_-YOUR-AI-READINESS-TO-EXPORT-AI-TOOLKIT.docx

57. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/0990bb77-4f7c-4579-88eb-43651b480f34/Detailed-Summary-of-Toolkit-3_-Your-AI-Supported-E.docx

58. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/2fa29b95-d5d7-4201-8071-ba563ef8e5a1/Toolkit-2-Your-Export-Readiness-Evaluation-3-1-4.docx

59. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/b9cf213f-62c8-406d-b127-f8812b4ea7c7/Toolkit-3-Your-Export-Strategy-Toolkit-7.docx

60. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/4e34a9e4-89a3-4664-b469-efe1060b6a1b/Toolkit-4-A-QCGP-for-Export-Markets.pdf

61. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/fd4b1192-b11e-4d18-971c-40c6dab92bb7/TOOLKIT-5-Customer-Persona-Development-and-Conte.docx

62. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/collection_b4c0e730-57df-4b5d-a30c-63ddcd093c26/10c9b2be-99b4-427d-906e-b9c9da3e6db0/Why-North-Sea-Energy-Companies-Must-Accelerate-Glo.pdf