Australian Government

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

MERNAP Issues Paper: Skills and Training

February 2024

Contents

1. Introduction

The Australian Government has legislated an economy-wide target of reaching net zero greenhouse gas (GHG) emissions by 2050. To deliver on this commitment, the Government is developing a Net Zero Plan, including six sectoral decarbonisation plans covering electricity and energy, transport, industry and waste, agriculture and land, resources and the built environment.[1] For the transport sector, the Government is developing a Transport and Infrastructure Net Zero Roadmap and Action Plan to examine GHG emissions reduction pathways across all transport modes (road, aviation, maritime and rail), including supporting infrastructure.[2] One element of the transport sectoral plan is a Maritime Emissions Reduction National Action Plan (MERNAP).[3]

Development of the MERNAP will seek to identify and prioritise actions to decarbonise our maritime transport sector, advance the development of green shipping corridors from Australia, and contribute towards reducing international shipping emissions.

The MERNAP is being prepared through a series of thematic issues papers.[4] The first issues paper on regulations and standards was released in September 2023. The second issues paper, released in December 2023, examined potential energy provision and abatement technologies for Australia's maritime sector. This third paper in the series considers the sector's skills and training needs to facilitate the green maritime transition.

Through consultation on this third paper on skills and training, the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (the Department) would like to better understand industry and community viewpoints – specifically how they are planning for future skills and training needs in a decarbonised maritime sector. This understanding, along with advice from the Transport and Logistics Jobs and Skills Council (JSC), will help inform the development of short, medium and long-term approaches in the MERNAP to support government and private sector initiatives. It is acknowledged that, as part of the strategic fleet initiative, industry and the JSC has been consulted on skills and training requirements. This paper differs by specifically covering the training needs for a decarbonised maritime sector.

Submissions to this paper will be used to provide advice to Government about potential future policy settings. Submissions can be made by close of business **12 March 2024** via email to: MERNAP@infrastructure.gov.au

2. Purpose

The MERNAP aims to:

- support Australia's national emissions reduction targets and contribute to global decarbonisation of shipping;
- future-proof the Australian maritime sector and avoid a late, costly and disruptive transition by setting early signals;

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[1] Net Zero - DCCEEW

[2] Transport and Infrastructure Net Zero Roadmap and Action Plan | Department of Infrastructure, Transport, Regional Development, Communications and the Arts

[3] Charting course towards zero maritime emissions for Australia | Ministers for the Department of Infrastructure

[4] Charting Australia's Maritime Emissions Reductions | Department of Infrastructure, Transport, Regional Development, Communications and the Arts

- signal to global partners Australia's clear pathway to net zero emission shipping in our waters and ports; and
- promote an equitable transition for the maritime sector, particularly for the maritime workforce.

To support the transition to a decarbonised maritime sector and an equitable transition for workers, Australia's skills and training architecture will need to be responsive to changing maritime skills needs and align with international certification systems, as guided by the International Maritime Organization (IMO).

This paper explores the types of skills that may be required, as well as current and possible training approaches. This paper does not provide 'answers' as to the best solution for the skills and training requirements for each segment of Australia's maritime sector, rather aims to present information as a 'scene-setter' to stimulate feedback from industry and other stakeholders. Throughout the paper, questions are posed to test assumptions on likely approaches to help inform the Department's recommendations to Government in the final MERNAP.

3. International Context

In July 2023, the IMO revised its GHG reduction strategy for international shipping to reach net zero emissions by or around 2050, with indicative checkpoints to decrease GHG emissions by at least 20%, striving for 30%, by 2030, and by at least 70%, striving for 80%, by 2040, compared to 2008 levels. The revised strategy also includes an ambition for the uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5%, striving for 10%, of the energy used by international shipping by 2030. The IMO is currently developing a basket of mid-term measures incorporating technical and economic elements for adoption by 2025. Under consideration is a GHG fuel standard, where the GHG intensity of the fuel used is set to decline over time, as well as GHG pricing mechanisms.

In response to the new GHG reduction strategy, the IMO's World Maritime University (WMU) and Lloyd's Register are developing a baseline training framework to equip seafarers with the necessary skills and training for the decarbonisation transition, to be completed by mid-2025.[5] This initiative will first be trialled in Asia, with the aim of making the training programs available to all IMO member states. Concurrently, a comprehensive review of the Seafarer Training Certification and Watchkeeping (STCW) Convention and Code is being undertaken by the IMO. Emerging decarbonisation technologies on ships and ship operations have been identified as part of this review. A number of papers to address training to work on vessels operating with alternate fuels and technologies have been submitted for discussion at the upcoming IMO Sub-Committee on Human Element, Training and Watchkeeping meeting in February 2024.

In support of a just transition for international maritime workers, the Maritime Just Transition Task Force was established during the 2021 United Nations Climate Change Conference (COP26) by the International Chamber of Shipping (ICS), the International Transport Workers' Federation (ITF), the United Nations Global Compact, the International Labour Organization (ILO) and the IMO. The Task Force released its position paper in November 2022[6] outlining the scale of upskilling needed for the world's 1.89 million seafarers to achieve a successful global maritime transition. The position paper highlights the need for urgent investment in training and upskilling for maritime workers in alternate fuels and technologies with a focus on safety for seafarers, ships, communities and the environment. The Task Force calls on the shipping industry to shift to a

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[5] IMO LAUNCHES SEAFARER DECARBONISATION TRAINING PROJECT - Clean Shipping International

[6] Shipping decarbonization action plan launched to upskill global seafaring workforce | International Chamber of Shipping (ics-shipping.org)

decarbonised future in a way that creates decent work and leaves no one behind, and for governments to revise or establish standards and training requirements for alternative fuel types in support of new skills and training.

4. Domestic Context

Australia has an economy-wide target to reach net zero by 2050 and aims to reduce total emissions by 43% below 2005 levels by 2030. Over the past two decades, Australia's domestic maritime sector has contributed around 2 million tonnes (Mt) of GHG emissions per year, accounting for approximately 0.4% of Australia's total emissions.[7] The maritime sector faces significant short and long-term challenges in emissions reduction, from a technical perspective (as explored in Issues Paper 2), and a skills and training perspective. The global and domestic maritime industries are responding to these challenges, and are adopting low emissions technologies and energy sources. In support of these efforts, a comprehensive and forward-looking approach to future-ready skills for the maritime sector will ensure the benefits flow through to Australian workers and the Australian economy.

Like any other energy producing or using sector, decarbonisation in the maritime industry necessitates new skills and an adaptable workforce. And like the other energy using sectors, the maritime industry will be facing competition in recruiting people with transferable skill sets. Current trends in the global maritime sector indicate a multi-energy source and multi-technology future. Given the broad range of decarbonisation approaches, an appropriately skilled workforce is essential for an effective decarbonisation transition. Equipping the workforce with the necessary skills can enhance the maritime industry's performance and foster innovation. Moreover, an emphasis on a just transition recognises the importance of ensuring the maritime workforce is adequately prepared for the changing landscape, promoting social equity and inclusivity.

Australia-wide, the clean energy supply workforce is expected to grow from approximately 53,000 in 2023 to 84,000 by 2050.[8] There are existing economy-wide policy frameworks to support the growth of the clean energy sector as well as skills and training architecture and initiatives to support changing workforce skills needs.

Jobs and Skills Councils

Ten Jobs and Skills Councils (JSCs) have been established by the Australian Government to provide industry with a stronger voice to ensure Australia's vocational education and training system delivers better outcomes for learners and employers. JSCs bring together employers, unions and governments in a tripartite arrangement to find solutions to skills and workforce challenges. The Government has established a national network of 10 JSCs to provide leadership to address skills and workforce challenges for their industries. JSCs provide advice to Government on future skills needs and additional training required to meet these needs.

The newly created JSC for the transport and logistics sector – Industry Skills Australia (ISA) – includes the freight and supply chain sectors of maritime, rail, aviation, transport and logistics and the emerging sectors of omnichannel logistics and distribution and space transport and logistics. ISA will identify skills and workforce needs for its sectors, map career pathways, develop contemporary Vocational Education and Training (VET) training products, support collaboration between industry and training providers to improve training and

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[7] Data taken from the National Greenhouse Accounts National inventory by economic sector | ANGA (climatechange.gov.au)
[8] The Clean Energy Generation | Jobs and Skills Australia

assessment practice, and act as a source of intelligence on issues affecting their industries. A key function of ISA is to work with industry to undertake workforce planning.

ISA has developed Initial Workforce Plans for each of its sectors. ISA's Maritime Industry 2023 Initial Workforce Plan summarises the industry and presents an overview of future workforce challenges. The Plan identifies that new technology and carbon emission reduction strategies will have skill implications in the future, and that new skills and training requirements for the maritime sector will need to be reflected in training products.

ISA is undertaking consultation to further understand the drivers and challenges impacting industry and the solutions to address the workforce challenges of industry, to inform its 2024 Workforce Plan.

Other Government skills and training initiatives include:

- In January 2023, the Department of Employment and Workforce Relations launched a New Energy Apprentices program to support up to 10,000 apprentices in technical and trade areas related to clean energy transitions.[9] This will assist in increasing the size of the workforce to meet the economy-wide decarbonisation targets.
- The Commonwealth, States and Territories have a 5-year joint National Skills Agreement to strengthen the Vocational Education and Training (VET) sector.[10] Supporting the net zero transformation is a key priority of the National Skills Agreement.
- The Net Zero Economy Agency, which commenced on 1 July 2023, is responsible for supporting workers in emission-intensive industries to access new employment and skills.[11]
- The 'Equal by 30' campaign is a public commitment by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) to support women in the clean energy sector.[12] The main goal is for equal pay, equal leadership, and equal opportunities for women.
- DCCEEW has developed the First Nations Clean Energy Strategy to give First Nations People a say in renewable energy policies and programs to ensure cultural heritage, knowledge, and connection to land and sea Country is respected, and allow First Nations People to participate in and benefit from a decarbonised society.[13]

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[9] New energy apprenticeships to power Australia's path to net zero | energy.gov.au
[10] National Skills Agreement - Department of Employment and Workplace Relations, Australian Government (dewr.gov.au)
[11] Our work | PM&C (pmc.gov.au)
[12] Equal by 30 - DCCEEW
[13] First Nations Clean Energy Strategy | energy.gov.au

- The Australian Government's Maritime Strategic Fleet Taskforce 2022 has recommended specific measures to support the sector's future workforce needs – which are under consideration by the Government. These include coordinated and expanded skills and training functions, a government cadetship program funded by a maritime industry training levy, mandatory training berths on strategic fleet vessels, clearer coordination between Defence and civilian maritime training and qualifications, and targeted skilled migration.

Questions for Industry Stakeholders:

- *How much of the current government skills and training support for the decarbonisation transition are you aware of – more broadly and specifically in relation to the maritime sector?*
- *Are there specific impediments for maritime sector employers / employees to access government skills and training programs?*
- *How can government skills and industry effectively prepare a skilled workforce for a decarbonised maritime sector? What specific skills differentiate the maritime workforce from the other sectors in decarbonising?*
- *When will you need access to a workforce posessing relevant skills to design, implement and work safely in your decarbonised operations (Now, 3, 5, 10 years)?*

5. Workforce, Skills and Training

In 2023, the maritime industry in Australia employed approximately 26,000 workers across passenger and freight transport, tourism and support services. The average age of Australia's maritime worker is 45 years, with female participation making up only a quarter of the workforce.[14] The size of the maritime workforce has decreased by 6.5% between 2011 and 2021, compared to an overall increase in the Australian labour workforce by approximately 20%.

Around 52% of maritime workers hold a vocational education qualification. Maritime training is delivered by 60 registered training organisations across Australia.[15] Key skills in servicing the industry include public safety and security, transport logistics, administration, management, telecommunications, navigation, marketing, and mechanical engineering. Recent industry and government analysis have shown that there are several skills shortages across Australia's maritime industry. These include shortages of masters, officers, engineers, and integrated ratings.[16]

Australia's ports rely on many workers, from those who are employed in entry-level jobs such as lashing, to medium-skilled workers such as electricians, through to higher-skilled professionals such as marine pilots. The principal occupations of workers in the major port precincts are technicians and trade workers (23%), followed by machinery operators and drivers (17%).[17] For Australia's diverse port sector, variations in conditions and technologies can mean that the exact skills needed for specific roles may vary between ports, and even between different firms conducting the same task at the same port. Container terminals, for

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[14] Maritime 2023 Initial Workforce Plan.pdf (azureedge.net)
[15] Maritime 2023 Initial Workforce Plan.pdf (azureedge.net)
[16] Maritime 2023 Initial Workforce Plan.pdf (azureedge.net)
[17] is_056.pdf (bitre.gov.au)

example, rely more on onsite, unaccredited training (reflecting workplace relations arrangements and site-specific needs), professional on-water occupations like marine pilots, tug masters and engineers usually combine vocational education and training or higher education qualifications with extensive blue-water experience. While there has been no significant findings of skills or labour shortages across Australia's ports sector,[18] decarbonisation of ports necessitates new approaches that will require ports to compete for skills from the competitive clean-energy workforce.

5.1 Training Requirements

The IMO's International Convention of Standards of Training, Certification and Watchkeeping for Seafarers 1978 (STCW) details the standards of competence and certification for seafarers in international waters.[19] Given that Australia is a signatory to STCW, the Australian Maritime Safety Authority (AMSA) acts as our 'Administration' organisation, managing requirements and taking full responsibility for international maritime training regulation/accreditation. The STCW outlines requirements for courses to be approved by the Administration, the various training and certification arrangements for the Administration to follow, compliance measures such as a 5-yearly independent evaluation to the IMO, and the issuance of certificates of competency to manage compliance. AMSA monitors training and assessment of competence carried out by registered training organisations, which contributes to an AMSA licence under the STCW.

The Navigation Act 2012 plays a crucial role in governing various aspects of Australia's maritime industry.[20] In relation to skills and training, the Navigation Act provides legislative powers over seafarers' qualifications and welfare in accordance with the IMO, ILO, and the United Nations (UN). For seafarers on Australian vessels operating in international waters, the Navigation Act mandates holding an international certificate in compliance with STCW.[21] These international certificates are issued in accordance with Marine Order 70 (Seafarer Certification) 2014, formulated under the Navigation Act 2012.

In contrast seafarers working on Australian domestic vessels within Australian waters required specific domestic certifications, also known as near coastal tickets. The requirements for these certificates are developed by AMSA to meet the operation needs and environmental conditions encountered around the Australian coast. The certificate requirements are prescribed by Marine Order 505 and enacted by the Marine safety (Domestic Commercial Vessel) National Law Act 2012, also known as the National Law. MO505 specifically caters to the unique requirements of the domestic maritime operations, acknowledging that these differ from international standards in certain aspects. These certifications are developed and maintained by AMSA in conjunction with subject matter experts, and they are drawn from domestic certifications in other countries with inclusion of requirements specific to the Australian context. The Maritime Training Package is then updated to reflect the revised MO505. There is often a long lead time when developing domestic training packages due to the need to ensure that all the above collated information and assessments are high quality, as well as current.

Australia's ports employ a diverse range of workers across nearly every state and territory in Australia. As such, the regulations around land-side trade skills certifications vary depending on the state or territory laws. Examples of this include differing training requirements for electrical and gas fitting trades across jurisdictions, as well as differing work health and safety regulation requirements related to skills certifications. This diversity of frameworks for skills certifications in ports may pose some challenges to decarbonisation

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[18] Overview - Lifting productivity at Australia's container ports: between water, wharf and warehouse (pc.gov.au)
[19] Changes to domestic certificates of competency from 1 January 2023 — new Marine Order 505 (amsa.gov.au)
[20] Navigation Act 2012 (amsa.gov.au)
[21] International qualifications (amsa.gov.au)

efforts, such as the bunkering of low or zero emissions fuels, or use of shore power, as ship operators need to ensure they are complying with each jurisdiction's training requirements.

5.2 Certification for Domestic Maritime Sector

Both international and domestic certificates ensure competency and safety of seafarers. To receive certification, seafarers must complete an approved study course and qualifying amount of sea time. Depending on the job role, some qualifications can take up to 10 years to complete and have limited delivery locations. Students must complete an AMSA approved course at an approved Registered Training Organisation (RTO) to achieve a Certificate of Competency. There are 60 RTOs in Australia who provide AMSA approved training programs.

Under Australia's Vocational Education and Training (VET) system, the maritime training package covers all international and near coastal tickets for RTOs. However, RTOs have the challenge of making substantial cost and time investments to register, develop, and sustain training courses to impart specialised and technical maritime skills.[22] The main challenges for RTOs are achieving economies of scale in offering cost-effective courses and the shortages of high quality and qualified teachers. This is especially difficult due to low enrolment numbers. Moreover, the low enrolment rate directly hampers the ability of RTOs to recover the substantial investment made for the specialised course. It also leads to a limited number of RTOs providing specific courses, inconveniencing seafarers who may have to travel far for training.

To address skills shortages in critical industries, the Australian Government, in partnership with state and territory governments, has committed to providing increased funding for entry level courses to improve the capability and capacity of the Technical and Further Education (TAFE) system. From January 2023, $1 billion was provided for 180,000 Fee-Free TAFE and vocational education places for 2023 courses. The Australian Government has agreed with states and territories to extend Fee-Free TAFE to support a further 300,000 Fee-Free TAFE places from 1 January 2024 to 31 December 2026, with an investment of $414.1 million. The Northern Territory and Western Australia have included some maritime qualifications on their course lists for Fee-Free TAFE from 2024-2026.

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[22] Maritime 2023 Initial Workforce Plan.pdf (azureedge.net)

6. Skills Challenges for a Decarbonised Maritime Sector

6.1 Economy-wide Decarbonisation Challenges

The Clean Energy Council has identified that Australia is facing a shortage of the necessary skills to decarbonise our economy. There are insufficient teaching candidates with relevant experience and qualifications in renewable energy, particularly engineers and electricians. Across the candidates who are suitable, the Clean Energy Council have identified the largest deterrents as insufficient pay, coupled with the frequent requirement to work in regional or remote locations.[23] The majority of the workforce is employed in the construction phase, which causes a higher degree of employment variability. As such many workers who are seeking longer term employment are only offered shorter term contracts.[24] Another reason for the skills shortage is the low representation of women, who only account for 2-34% of workers in key occupations within the decarbonisation sector, compared to the 51% of women making up the national workforce.

The Clean Energy Council has posited 6 recommendations to address the skills shortages in the clean energy industry.[25] The recommendations suggest focusing on:

- calibrating higher education funding models to meet the needs of clean energy industries;
- increasing collaboration between federal and state governments to anticipate workforce needs;
- raising the profile of working in clean energy as an opportunity for all Australians to attract a larger pool of talent;
- establishing a Federal Government Transition Authority to work with all levels of government; and
- enhancing the VET sector's capacity to understand and meet the demands of industry and raise the international profile of Australia as a centre of clean energy expertise.

Jobs and Skills Australia[26] has identified three opportunity areas for the education and training sectors to support the required skills and training needs for net zero economy – system design, funding and program design, and student pipeline. System design areas includes frameworks to facilitate deeper collaboration between VET, tertiary education and industry; new models for course delivery to align graduates with emerging needs; and consistent approaches to occupational licencing. Funding and program design include the development of responsive curriculums to emerging needs, serving thin markets and regions through competitive models, minimising capital constraints by collaboration, and incentivising employer involvement in education and training. Student pipeline includes increasing participation in STEM (science, technology, engineering and maths), growing the trainer, teacher and researcher workforce, supporting more First Nations people and women in education and training, and better targeting of incentives for upskilling. A well-designed and fit-for-purpose skills migration program can also assist international students that would like to remain in Australia post studies.

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[23] Skilling the Energy Transition | Clean Energy Council
[24] The Clean Energy Generation | Jobs and Skills Australia
[25] Skilling the Energy Transition | Clean Energy Council
[26] The Clean Energy Generation | Jobs and Skills Australia

6.2 Maritime Sector Decarbonisation Challenges

For the maritime sector, decarbonisation presents various challenges,[27] including a need to accelerate and increase investment in training globally. Without considering the decarbonisation focus, there are still major shortages of marine engineers, which will be exacerbated during the transition. Furthermore, the maritime regulatory environment is slow paced in comparison to technological advancements, creating uncertainty around internationally-consistent training investments. This is exacerbated by frequent developments in alternative fuel sources and technologies, leading to a lack of clarity surrounding the feasibility of different options. Like other industries transitioning to net zero, fast-moving developments are necessitating a workforce that is 'higher-skilled', 'multi-skilled' and able to adapt to new approaches. This becomes more challenging, as knowledgeable and competent trainers are already in short-supply across the maritime sector. It is important to consider the perception of the decarbonisation transition by workers in the fossil fuel industry to ensure a just transition whilst working on reskilling the future workforce.

The Maritime Industry 2023 Initial Workforce Plan under ISA has identified challenges related to the development of a decarbonised maritime sector. Underway is the development of several national infrastructure projects that involve the maritime industry, such as renewable energy sources (e.g. offshore wind farms). The challenge arises due to the small maritime workforce to support these projects. Further, the certifications and training in relation to new technology and carbon emission reduction strategies, necessitates the acceleration of regulatory compliance and safety standards.

Questions for Industry Stakeholders:

- *What are the major skills shortages that are impacting the maritime sector's decarbonisation transition?*
- *In developing your sustainability plans / planning your decarbonisation pathway, what strategies have you considered for accessing critical skills that you may need?*
- *How are existing skills shortages being impacted by the need for new skill sets to transition the maritime sector towards net zero?*

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[27] LINK-2-document-DNV-Report-Insights-into-Seafarer-Training-and-Skills-for-Decarbonized-Shipping-Nov-2022.pdf (ics-shipping.org)

7. Future Needs

The Australian Government has implemented several incentives and policies to support the growth of a resilient maritime workforce. In light of the shift towards a decarbonised maritime sector, AMSA has commenced work to review and update training certifications to support the safe adoption of emerging technologies in domestic commercial vessels. Other relevant transport sector training and competency frameworks will also be reviewed and leveraged where possible to support this work (e.g. heavy vehicle mechanical training programmes for hydrogen fuelled and electrified busses and trucks). AMSA are also collaborating with international regulators to share knowledge on regulatory challenges and policy development initiatives to support emerging vessel technologies for domestic commercial vessels.

One of the main challenges in the future lies in the necessity for a skilled workforce that is capable of implementing and managing decarbonisation initiatives effectively.[28] The decarbonisation transition requires a workforce that is equipped with up-to-date knowledge and expertise. This includes proficiency in emerging technologies, alternative fuels, and advanced propulsion systems.

The maritime sector's trajectory towards not only decarbonisation but increased digitalisation and automation needs a workforce that is equipped with improved digital literacy. Proficiency in information technology (IT), digital technology, technical expertise and organisation competence is necessary to meet the future demands of the sector. It is essential that future maritime professionals remain versatile, as the ability to move between jobs at sea and control room positions ashore will be vital. Specialisation may also be more prevalent, requiring a strategic approach to provide the workforce with specialised skills relevant to the demands of a decarbonised maritime sector. The training initiatives should cater to different levels of the workforce. Training considerations are important as the sector continues to utilise alternative fuel technologies.

The Maritime ISA's Maritime Industry 2023 Initial Workforce Plan[29] segments the maritime industry into five occupational areas:

- Navigation (commanding and navigating vessels)
- Engineering (maintaining marine systems, equipment, operation and maintenance of machinery and ship engines)
- Deck operations (performing duties and functions on a vessel and/or assisting with deck or engine work)
- Support operations (performing duties and functions to support vessel operations)
- Autonomous operations (working or supervising Autonomous Maritime Systems operations near coastal waters)

Looking to the future of a decarbonised sector, the Navigation area will require workers such as masters and coxswains to be proficient in operating vessels powered by alternative fuels such as hydrogen or ammonia, monitoring emissions, and implementing energy-efficient practices. Training programs will need to prioritise safety measures, emergency response procedures, and efficient use of alternative fuel technology. Emergency response and safety training is critical with the introduction of new technologies and operational methods. Onboard crew members need to be well-trained in recognising and addressing potential issues. Health and Safety Representatives onboard must also be empowered under legislation to pause or stop operations when uncertainties arise. Fostering a safety culture amongst the maritime workforce is paramount, encompassing

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[28] Seafarer training and skills for decarbonized shipping DNV
[29] Maritime 2023 Initial Workforce Plan_0.pdf (azureedge.net)

not only technological considerations but also accounting for human factors, such as wellbeing and mental health.

Engineers play a pivotal role in implementing and maintaining alternative fuel technologies on ships. A comprehensive understanding of the operations in terms of maintenance that can be done at sea if something goes wrong is vital. Engineering training for a future decarbonised sector will need to cover the installation, maintenance and troubleshooting of low emission propulsion systems, as well as renewable energy sources. Being well-versed in data analytics and digital solutions will also become increasingly important.

The needs of the deck operations area are diverse - the skillset required for a marine cook is very different to a seafarer. Skills may include adapting cooking practices to sustainable food sourcing, waste reduction, proficiency in handling new technologies and equipment, efficient cargo handling techniques. Overall, greater familiarity with sustainable practices, safety protocols and adapting roles to environmentally conscious operations will be essential.

Support operations personnel will also require an updated skillset. Their training will need to cover the efficient and safe handling of vessels using alternative fuels and energy sources, ensuring secure and environmentally sensitive mooring, efficient traffic flow management, understanding the integration of sustainability technologies onboard various vessels, and port waste disposal. Training programs will need to prioritise efficient resource management, waste reduction strategies, and comprehensive understanding of alternative fuels and energy sources.

For those involved in autonomous operations, training programs will need to focus on advanced skills in supervising and working with autonomous maritime systems. This includes expertise in autonomous navigation to reduce carbon emissions, collision avoidance and environmental regulations. The emphasis of continuous monitoring of environmental performance metrics and staying updated on advancements in low emissions autonomous systems will further equip professionals for the evolving landscape of decarbonised maritime operations. Ensuring a just transition for maritime workers in the face of increasing automation is crucial. The transition should focus on reskilling and upskilling employees to adapt to the new technological landscape.

Furthermore, emphasising gender equity is essential, as it can significantly mitigate skills shortages in the maritime sector. By activity recruiting and supporting women in maritime roles, the industry can tap into a largely underutilised talent pool, fostering diversity and innovation. This approach not only helps in addressing the gender imbalance but also broadens the range of skills and perspectives within the sector, contributing to a more resilient and dynamic workforce.

To meet these developing needs, collaboration with educational institutions, industry experts, and technology providers is essential. The JSC will work with these stakeholders to update training products to support the workforce in the decarbonisation transition in Australia's maritime industry. Emphasising a culture of continuous learning and adaption within the maritime workforce will be crucial to meet the sector's changing demands and position Australia as a leader in maritime decarbonisation.

Questions for Industry Stakeholders:

- *What are the essential components that should be considered in the development of training for your segment (eg port services, fishing, tourism, coastal shipping, international seafaring) of a decarbonised maritime sector?*
- *How do skill shortages for decarbonisation initiatives vary between regional and city areas within Australia?*
- *What new or emerging platforms can strengthen training delivery reach in your segment of the maritime sector?*
- *To what extent do you think skills in the clean energy sector are transferable to maritime decarbonisation initiatives and what level of comfort would you have in deploying those skills directly in your operations?*
- *As an employer, what would you need to be confident that training programs are keeping up with the latest advancements in low and zero carbon technology developments and industry needs given the uncertainty around fuel and technology choices?*
- *How do you see your maritime energy transition providing opportunities for attracting talent from other clean energy sectors and also increasing female participation in the maritime sector?*