

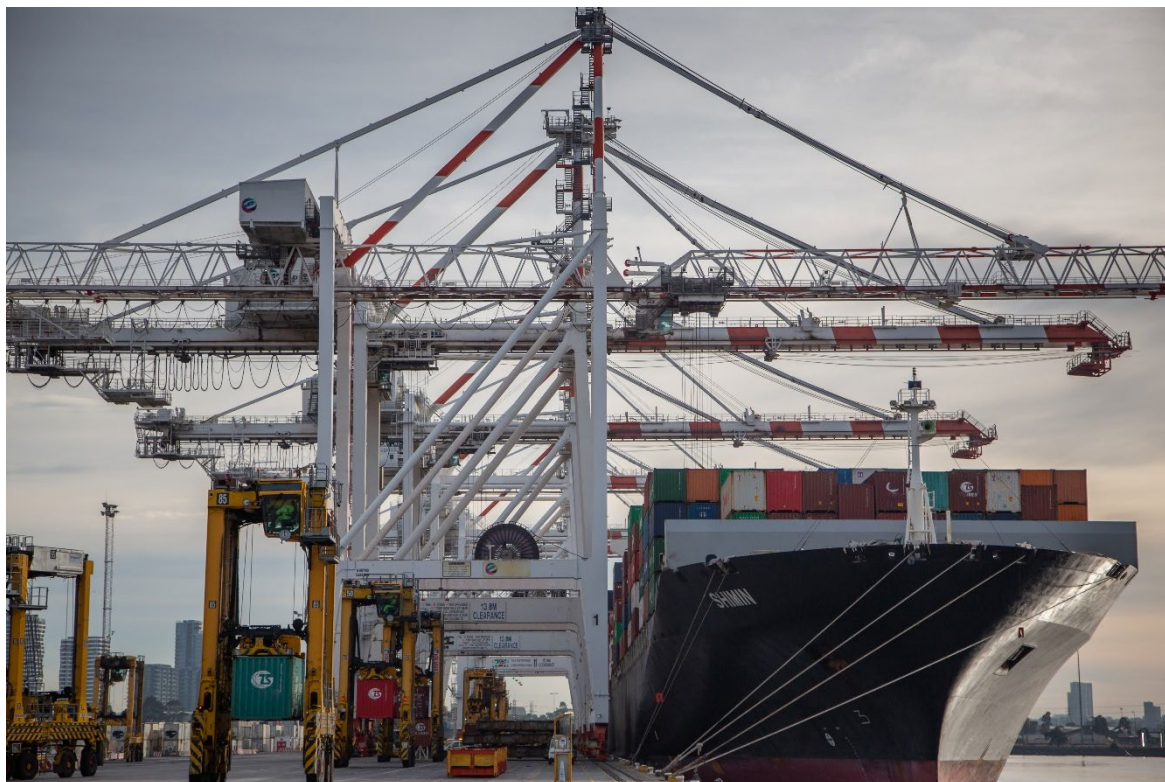


Australian Government

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

Australia's Maritime Emissions Reduction National Action Plan (MERNAP)

August 2026



Contents

Executive summary	5
Introduction	9
Theme 1: Energy	13
Action 1.1: Support increased green energy exports	15
Action 1.2: Encourage investment in research and development for maritime innovation	16
Theme 2: Ports	17
Action 2: Enhance port infrastructure and operations to support maritime decarbonisation	18
Theme 3: Shipping	19
Action 3: Continue IMO engagement and expand green and digital shipping corridor activities	21
Theme 4: Domestic commercial vessels (DCVs)	22
Action 4.1: Support demand aggregation through collaboration among regional operators	23
Action 4.2: Support first movers by reducing regulatory barriers and mitigating costs	23
Theme 5: Skills and training	24
Action 5: Ensure timely and effective upskilling of the maritime workforce	25
Conclusion and next steps	26
Appendix 1: Consultative group – terms of reference	27
Appendix 2: Development of the MERNAP	30
Appendix 3: Current Australian Government initiatives	31
Appendix 4: Energy efficiency technologies	36
References	38

Glossary

2023 IMO GHG Strategy (2023 Strategy on Reduction of Greenhouse Gas Emissions from Ships): The updated IMO strategy agreed in July 2023 that sets strengthened targets and timelines for cutting absolute and intensity-based greenhouse gas emissions from international shipping.

AMSA (Australian Maritime Safety Authority): The federal agency responsible for maritime safety, marine environment protection and search-and-rescue coordination in Australian waters.

CO₂ (carbon dioxide): A naturally occurring greenhouse gas produced by respiration and the combustion of carbon-based fuels; the reference gas for measuring climate impacts.

CO₂-eq (carbon dioxide equivalent): A unified metric that expresses the global warming potential of various greenhouse gases as the amount of CO₂ that would have the same warming effect over a specified time horizon.

DITRDCSA (Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts): The Australian Government department responsible for national policy, regulation and investment across infrastructure, transport, regional development, communications, sport and the arts.

FAME (fatty acid methyl ester): A biodiesel produced by transesterifying vegetable oils or animal fats with methanol. It can be blended with, or substituted for, conventional diesel in marine engines.

Guarantee of Origin (GO): A voluntary Australian Government scheme for the emissions accounting of products and certification of renewable electricity.

H₂ (hydrogen): A colourless, odourless gas that, when used as a fuel, produces only water vapour at point of use. It can be generated with near-zero emissions if renewable or low carbon energy powers the production process.

HVO (hydrotreated vegetable oil): A renewable diesel made by hydrogenating vegetable oils or waste lipids, delivering a drop-in fuel with lower sulphur and aromatics and reduced life-cycle emissions compared with fossil diesel.

IMO (International Maritime Organization): The United Nations specialised agency responsible for setting global standards for the safety, security and environmental performance of international shipping, including developing treaties, guidelines and emissions-reduction strategies.

ISA (Industry Skills Australia): The Jobs and Skills Council for the Australian transport supply chain industries. ISA identifies workforce and skills needs, develops training and workforce solutions and advises the Australian Government on workforce and skills priorities.

kWh (kilowatt hour): A unit of energy equal to one kilowatt of power operating for one hour.

LCLF (low carbon liquid fuels): Liquid energy carriers, such as advanced biofuels, e-fuels, or hydrogen-derived liquids, that emit significantly less life-cycle greenhouse gas than conventional petroleum fuels.

LNG (liquefied natural gas): Natural gas cooled to -162°C to convert it to a liquid for easier storage and transport. It can be used as a marine fuel and it offers lower CO₂ emissions than heavy fuel oil.

MJ (megajoule): A unit of energy equal to one million joules, commonly used to measure the calorific value of fuels.

N₂O (nitrous oxide): A potent greenhouse gas that is emitted from combustion processes with a global warming potential of roughly 270-300 times that of CO₂ over 100 years.

Roadmap (Transport and Infrastructure Net Zero Roadmap and Action Plan): An Australian Government sectoral plan that charts the pathways and actions for the transport and infrastructure sectors to achieve net-zero greenhouse gas emissions.

TtW (Tank-to-Wake): An emissions accounting boundary that captures greenhouse gases released from burning fuels on board a vessel, excluding upstream production and transport emissions.

WtT (Well-to-Tank): The upstream portion of life-cycle analysis measuring emissions generated during extraction, processing and transport of a fuel up to the point it is loaded into a vessel's tanks.

WtW (Well-to-Wake): A full life-cycle emissions boundary combining WtT and TtW phases, thereby covering all greenhouse gases from fuel extraction through to combustion on board a vessel.

Executive summary

Australia's Maritime Emissions Reduction National Action Plan (MERNAP) is part of the Australian Government's broader strategy to achieve net zero emissions by 2050. The MERNAP identifies approaches to decarbonising our domestic maritime sector, contributing to the decarbonisation of international shipping and supporting the growth of Australia's low and zero carbon energy exports.

The MERNAP is intended to support competitiveness, prosperity and equitability in Australia's maritime and energy sectors as the global maritime sector transitions to a decarbonised future.

The MERNAP has been developed through extensive consultation with energy and maritime stakeholders. It is built on a comprehensive body of knowledge – encompassing the emissions profile of the maritime sector, low carbon fuels and technologies, and relevant Government initiatives.

Our consultations have found:

- The maritime sector is diverse and distributed. We must ensure equitable access to low emission technologies and infrastructure across different regions and vessel types.
- Australia is in a unique position in the Indo-Pacific region and has the potential to be a leader in both green energy exports and maritime decarbonisation.
- Actions taken now will support Australia's continued trade competitiveness.
- An orderly transition now will cost less than a late, hurried change to meet our legislated commitments to emissions reductions.
- Active participation in global initiatives is an accelerator for Australia's own maritime decarbonisation. It helps promote Australia's interests in the development of international standards and creates benefits from collaboration.
- Upskilling and reskilling the maritime workforce are essential for the safe management of new fuels and technologies. An appropriately trained and skilled workforce will ensure the sector can meet the technical and operational demands of the transition.
- The energy–port–shipping nexus is the core of a holistic approach to maritime decarbonisation. Advancements in one area support and enhance progress in others.

The MERNAP responds to these findings along the themes of the energy–port–shipping nexus, domestic commercial vessels, and skills and training. It presents seven areas for Government action.

Actions

Action 1.1: Support increased green energy exports

The Australian Government will further promote and support the use of low carbon fuels in shipping to reduce the carbon footprint of transporting Australia's green energy exports and the acceleration of the low carbon liquid fuels (LCLF) industry under programs such as the Future Made in Australia Innovation Fund. The Guarantee of Origin (GO) scheme in turn will enable the domestic producers and users of LCLF to make claims about the provenance and carbon intensity of such fuels.

Through a stocktake of programs, the Department will flag the requirements of the maritime industry with relevant programs. This work will feed into the development of a bunkering strategy to help guide investment in green fuels.

Action 1.2: Encourage investment in research and development for maritime innovation

The Australian Government will encourage industry and research institutions to invest sustainably and collaboratively in maritime innovation by focusing on energy efficiency and the development and use of low carbon fuels. The Department will work with the Clean Energy Finance Corporation, the Australian Renewable Energy Agency and other relevant bodies, and in alignment with the National Hydrogen Strategy, to support existing resources and expertise being used to accelerate research and development of cutting-edge maritime energy technologies.

The Department will work with agencies and report back to industry. The Department will develop a maritime business case to help guide agencies research and innovate.

Action 2: Enhance port infrastructure and operations to support maritime decarbonisation

The Australian Government will encourage and support investment in storage and bunkering facilities for low carbon fuels, shore power infrastructure and expansion of port energy capabilities. The Government will help drive digitalisation by providing clear direction and certainty to ports. In the first instance, the Government will consider and quantify the abatement benefits of implementing a Maritime Single Window and just-in-time arrival systems. The Government, in line with IMO mandates, is developing Australia's Maritime Single Window. Relatively low-cost energy efficiency investments can keep the maritime sector on track in reducing emissions until low carbon fuels and infrastructure reach commercial readiness.

Action 3: Continue IMO engagement and expand green and digital shipping corridor activities

The Australian Government will maintain engagement and participation in the IMO to influence the development of international regulations for decarbonisation. This includes accelerating the development and implementation of standards and guidelines that will facilitate the use of low carbon fuels. The Department will consult with industry and other relevant stakeholders on its positions at the IMO. The IMO will be further considering measures to decarbonise international shipping in December 2026.

The Department will expand its involvement in green and digital shipping corridors by collaborating with international partners to trial new technologies and operational practices. These corridors serve as testbeds for new fuel efficiency technologies and low and zero emission shipping solutions, stimulate partnerships across the energy–port–shipping nexus and help develop the required future international operating standards.

Action 4.1: Support demand aggregation through collaboration among regional operators

The Australian Government will promote collaborative partnerships between regional organisations and operators to aggregate demand for low emission technologies and fuels. By bringing together groups of operators with similar needs—such as those in the tourism or fishing industries—and facilitating engagement with low carbon fuel suppliers and service providers, the Government can lower barriers to entry and improve the economic viability of infrastructure investments, especially in remote or underserved regions. This is an important step in enabling regional operators to access low emission technologies and participate in the transition.

This action will support the development of low carbon fuel supply chains, build regional capacity and create green tourism opportunities. Working with industry peak bodies, the Department will establish a forum to facilitate partnership and demand aggregation proposals.

Action 4.2: Support first movers by reducing regulatory barriers and mitigating costs

The Australian Government will explore options to streamline maritime regulatory frameworks to facilitate the deployment of new fuels and technologies. A reduction in regulatory hurdles and first-mover financial burdens would support early adopters and encourage innovation to accelerate the transition to a low emission maritime industry.

As a first step, the Department will work with the Australian Maritime Safety Authority (AMSA) to identify opportunities to enhance the domestic regulatory framework to better accommodate emerging vessel technologies and reduce disincentives to their development and uptake (including by narrowing the types of vessels categorised as novel vessels).

Action 5: Ensure timely and effective upskilling of the maritime workforce

As the Jobs and Skills Council for the maritime sector, Industry Skills Australia (ISA) will work with AMSA, the maritime industry and training organisations to identify and help deliver the skills and training needed to support decarbonisation of the maritime sector. This will ensure workers are prepared for the technical and operational demands of the transition, maintaining high safety standards and supporting an equitable shift to low emission maritime operations.

Coordination

These actions can only succeed with robust coordination and collaboration across all levels of government and industry – particularly given the interdependencies between energy production, port infrastructure and shipping operations.

A coordination function supporting the Infrastructure and Transport Ministers' Meeting can be a single source of maritime decarbonisation information, oversee the implementation of initiatives, monitor progress, and adapt strategies as needed to respond to technological advancements and market developments. This mechanism will take advantage of the existing decarbonisation working group that sits under the Infrastructure and Transport Ministers' Meeting, and support informed decision-making and policy development across the Australian and state and territory governments. Coordination mechanisms should be established as the next step in implementing the actions identified in the MERNAP.

The actions in the MERNAP have been deliberately developed to take account of the significant Australian Government investments in maritime and energy decarbonisation initiatives. This includes:

- \$20 million for Australia-Singapore Low Emissions Technology initiatives for maritime and port operations.
- Funding to develop low carbon liquid fuels, including the \$1.1 billion Cleaner Fuels Program, and the \$250 million, as part of the \$1.5 billion Future Made in Australia Innovation Fund. To support these investments, the Government is consulting with industry on a market measure to drive demand and to reduce Australia's reliance on imported fuels releasing the consultation paper, *Securing Australia's Cleaner Fuels Industry*. Consultation closes on 15 September 2026.
- The Hydrogen Headstart program, which will deliver up to \$2.25 billion to large-scale renewable hydrogen projects.
- \$4 million to develop a green fuel bunkering strategy.
- \$51.7 million to develop a Maritime Single Window.
- \$16.9 million for the Maritime Skills and Training Initiative.
- \$55 million for a Transport Resilience and Capacity Kickstart pilot program to incentivise more freight to move via trains and cargo ships.

More information about Government initiatives is at Appendix 3.

Introduction

Australia's greenhouse gas emissions reduction targets for 2030 and net zero by 2050 are set out in the *Climate Change Act 2022*. In 2025, the Australian Government set its 2035 target of 62-70% below 2005 levels. To meet these targets, the Government published a Net Zero Plan for the whole economy in September 2025. This plan is supported by 6 sectoral plans tailored to the challenges and opportunities for emissions reduction in the following sectors: electricity and energy, transport and infrastructure, industry, agriculture and land, resources, and the built environment.

The Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts is the Australian Government Department with policy responsibility for maritime decarbonisation.

The Department has developed the Transport and Infrastructure Net Zero Roadmap and Action Plan (the Roadmap) to establish the pathway to decarbonisation of the transport and infrastructure sector as Australia transitions to a net zero economy. As one element of the Roadmap, the MERNAP provides analysis and a detailed strategy for reducing emissions across Australia's maritime sector. The MERNAP has been developed through co-design with the private sector, unions, peak bodies and government agencies across the value chain (see Appendixes 1 and 2) to ensure the plan aligns with industry views and Australia's emissions reduction objectives.

Maritime Emissions Reduction National Action Plan

The MERNAP is Australia's first national plan for reducing maritime emissions. It recognises that decarbonisation of the maritime sector is complicated by the sector's international linkages, long asset lives and critical role in the ongoing prosperity and security of Australia.

The MERNAP aims to:

- support Australia's national emissions reduction targets
- contribute to the global decarbonisation of shipping
- futureproof the Australian maritime sector
- set early signals to support an orderly transition and avoid unnecessary delays, costs and disruptions
- signal to global partners Australia's clear pathway to net zero emission shipping in our domestic waters and ports, and
- promote an equitable transition for the maritime sector, especially for the maritime workforce.

The information, approaches and opportunities set out in this plan contribute to a vision for competitive, prosperous and equitable maritime and energy sectors in a decarbonised future.

Vision

By 2050, Australia is taking full advantage of the global maritime decarbonisation transition. The benefits are shared across ports, the domestic commercial vessel sector and the energy sector by showcasing our unique comparative advantages and supporting an equitable transition for the maritime workforce.

The MERNAP will serve as a foundation to be built upon through ongoing government and private-sector investment, initiatives and collaboration.

Commercial and government-owned maritime operations have the most potential for decarbonisation and are therefore the focus of the MERNAP. While privately owned vessels are a significant portion of Australia's vessel inventory, their dispersed ownership and limited potential for emissions abatement means they have been purposely excluded from the MERNAP. The Department is aware, however, that significant decarbonisation innovation is occurring in this segment of the industry, and applauds these efforts.

A whole-of-system approach

The MERNAP adopts a whole-of-system approach and reflects five interconnected themes, with actions under each (Figure 1).

1. **Energy:** Green fuels, such as hydrogen, ammonia, methanol and biofuels, will play an important role in reducing maritime emissions. Australia is a potential producer and exporter of green fuels, and this has implications for fuel availability and infrastructure development.
2. **Ports:** Ports are pivotal in the energy–port–shipping nexus. With appropriate investment and infrastructure development, Australia's ports can be hubs for low carbon fuels and green energy exports.
3. **Shipping:** Pathways are required for decarbonising both domestic and international shipping. For Australia, this involves alignment with international maritime regulations, adoption of low carbon fuels and technologies, development of green and digital shipping corridors to prioritise and test innovative approaches, and making the most of opportunities that arise from global decarbonisation trends.
4. **Domestic commercial vessels (DCVs):** The diversity and regional spread of the DCV sector require the development of tailored pathways for decarbonisation, support for regional operators, demand aggregation, collaboration and implementation of supportive policies.
5. **Skills and training:** A successful and equitable transition to a low emissions maritime sector requires upskilling the maritime workforce to manage new technologies and fuels safely. Important steps include addressing regional skills gaps, ensuring worker safety and fostering collaboration between industry, government and training providers.

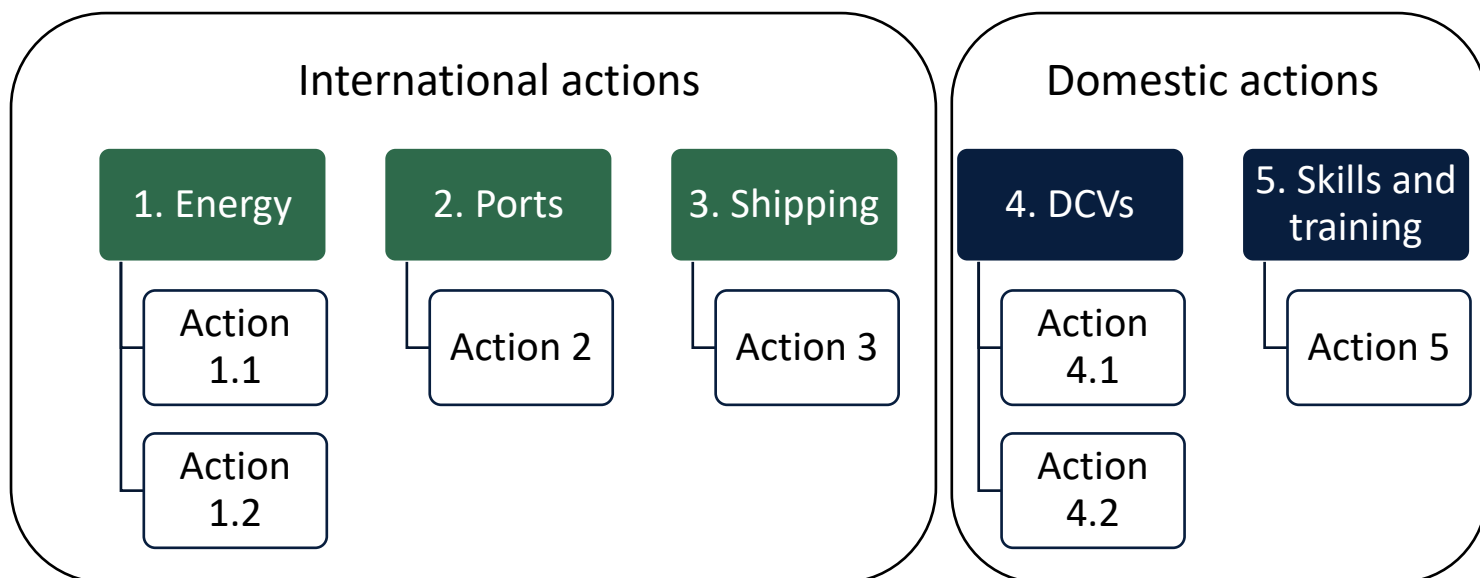


Figure 1: MERNAP themes and actions

The first three themes recognise the domestic maritime sector's link to the international sector through energy, shipping and ports. This 'energy–port–shipping nexus' is central to the MERNAP. Australia has significant opportunities to produce and export energy in the form of hydrogen-based fuels. Ports will be key for bunkering (supplying fuels to ships) and handling these fuels. The shipping sector will consume and export them. While hydrogen-based fuels are a key long-term solution, a multi-fuel future – including electrification and other low carbon fuels – is expected, along with new technologies and energy efficiency measures. Ports, energy providers and vessel operators are essential stakeholders in the adoption of decarbonised approaches. Their transition can be supported through coordination and workforce upskilling.

International alignment

Australia's strategies, detailed in the MERNAP, align with the 2023 International Maritime Organization (IMO) Strategy on Reduction of Greenhouse Gas Emissions from Ships (IMO 2023) and support global efforts to reduce shipping emissions, which account for about 3% of total global greenhouse gas emissions. Decarbonising our maritime sector helps meet global climate goals, while engagement with the IMO enables Australia to contribute to a cohesive regulatory framework and keep our ship services and ports competitive.

International Maritime Organization

- The IMO encourages member states to develop and submit voluntary national action plans to address emissions from ships. The MERNAP will be Australia's national action plan.
- In June 2021, the IMO adopted a short-term carbon intensity indicator measure aiming for a 40% reduction in emissions intensity, primarily through energy efficiency measures.
- Amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI were adopted, requiring ships to reduce emissions in line with a 50% reduction target by 2050, relative to 2008 levels, as established in the 2018 Initial IMO Strategy.
- In July 2023, these targets were revised to aim for net zero emissions from international shipping by or around 2050, with commitments to increase the uptake of alternative zero and near-zero greenhouse gas fuels by 2030, and indicative checkpoints for 2030 and 2040 (IMO 2023).

Australia's domestic maritime sector

Our maritime industry is important to the Australian economy. In 2024, the industry employed nearly 28,000 workers across passenger and freight transport, tourism and support services (ISA 2025). The average age of Australia's maritime workers is 45 years and women comprise about 5% of the workforce (AMSA n.d.).

Australia's trading fleet consists of 136 vessels owned or operated by Australian companies and registered either in Australia or overseas (BITRE 2025). Notably, only 11 vessels over 2,000 deadweight tonnage are Australian-flagged (Strategic Fleet Taskforce 2023).

Australia has more than 30,000 DCVs (AMSA 2024). These operate across diverse industries, including passenger transport, fishing and aquaculture, tourism, offshore oil and gas, and towage and port operations. The DCV sector is characterised by diversity in vessel types, uses and operational structures, ranging from small-scale tourism boats and fishing vessels to larger ships engaged in near-coastal freight and logistics. This sector is vital for regional connectivity, supporting local economies and providing essential services to remote and coastal communities.

Our maritime infrastructure includes 17 nationally significant ports, located in major capital cities and regional areas, and typically categorised as specialised bulk ports or mixed ports (BITRE 2014). An additional estimated 291 marinas support commercial and recreational vessels (Marina Industries Association 2023).

Shipping emissions

Global shipping accounts for around 3% of total anthropogenic greenhouse gas emissions. As an island nation, Australia relies heavily on shipping for international trade. We account for 14% of global sea freight and we are the fifth largest user of shipping services. Overall, about 99% (by volume) of our exports (mainly commodities such as iron ore, liquefied natural gas (LNG), coal and agricultural products) and imports (dominated by refined fuels and containerised goods arriving at capital city ports) are transported by sea (Ports Australia 2024). Coastal freight (between Australian destinations) is also significant. Each year, more than 6,000 cargo ships make over 30,000 port calls in Australia, encompassing both coastal and international voyages (BITRE 2025).

We therefore have a strong stake in the green energy transition of the shipping industry and the opportunities it presents.

The IMO is negotiating a regulatory framework to transition the international shipping sector to low carbon fuels with the aim of reaching net zero emissions around 2050 (IMO n.d.a).

As a transboundary transport mode, the decarbonisation of Australia's maritime services sector needs to align with global climate goals and fulfil our international obligations. Our active engagement with the IMO ensures Australia contributes to a cohesive global regulatory framework, preventing fragmented compliance regimes and supporting our national interest in reducing shipping emissions as part of the broader energy transition.

Australia's shipping emissions

Despite having the fifth-largest shipping task globally, ships carrying our cargo contribute only about 4% of global international shipping CO₂-e emissions. This is due to the energy efficiency of the large bulk carriers used for most of our trade and the relatively short distances to our major Asian trading partners.

Domestic maritime transport is the source of approximately 2 million tonnes of CO₂-eq emissions per year. This is about 2% of Australia's annual transport emissions and 0.4% of Australia's total annual emissions. The domestic shipping industry presents relatively small abatement potential.

Theme 1: Energy

Decarbonisation of the global maritime sector requires low carbon fuels. Australia has an opportunity to lead as both a consumer and exporter of these fuels. The Australian Government can support this opportunity by integrating the needs of the maritime sector into existing emissions reduction programs and research efforts.

Green fuel production is emerging as a significant industry in Australia (see Appendix 3). Numerous projects are focused on producing e-hydrogen, e-ammonia and biofuels from renewable sources. These fuels are essential for decarbonising sectors that are challenging to electrify, such as heavy transport, shipping and aviation.

Alternative maritime fuels

The maritime sector is expected to rely on an array of low carbon fuels and green technologies to sustain its operations. These are LNG, biofuels (FAME, HVO, bio-LNG, bio-methanol), e-fuels (e-hydrogen, e-ammonia, e-methanol, e-LNG) and battery electric propulsion (lithium batteries).

- **LNG** is a fossil fuel that already powers more than 800 ships (in addition to LNG-carriers that burn their own cargo as fuel) and can cut tank-to-wake (TtW) CO₂ by about 25%. LNG is commercially mature with growing Australian bunkering, however its lower energy density demands larger insulated tanks.
- **FAME (fatty acid methyl esters)** is a biodiesel that delivers very low or even negative WtT emissions, but the ISO 8217 blend cap of 7% means overall well-to-wake gains are modest. It offers full compatibility with existing diesel systems and may serve as a flexible transitional option as supply chains grow.
- **HVO (hydrogenated vegetable oil)** can replace diesel at any blend up to 100%, matching FAME's negative well-to-wake (WtW) emissions. While local production is currently limited, international developments may enhance availability and cost-effectiveness over time.
- **Bio-LNG (liquefied biomethane)** is made from wastes such as landfill gas or manure and offers strongly negative WtT emissions relative to diesel. It uses the same engines and bunkering as LNG.
- **Bio-methanol** is produced from biomass or solid waste and can achieve deeply negative WtT values. Its ambient liquid state simplifies storage and handling, making it attractive for scaling alongside improvements in engine compatibility and production capacity.
- **E-hydrogen** or green hydrogen produced via electrolysis delivers near-zero WtW emissions when used in hydrogen fuel cells. While its volumetric energy density and current infrastructure limitations make it most feasible for pilot deployments, rapid innovation in storage and distribution could unlock broader use.
- **E-ammonia** is synthesised from e-hydrogen and nitrogen. It is carbon-free at the point of use, although production emissions and potential N₂O release mean lifecycle reductions depend on clean power and after-treatment. It offers significant decarbonisation potential, particularly for long-distance shipping, provided safety systems, emissions controls (for N₂O), and bunkering infrastructure continue to evolve.
- **E-methanol** is produced by combining green hydrogen with captured CO₂. It has net-negative WtT emissions and about a one-third WtW saving. Despite its current cost premium and lower energy density, its liquid form and growing engine availability make it a candidate for future adoption as technology matures and costs decline.
- **E-LNG** is made from renewable H₂ and CO₂, and cuts WtT emissions by around 55%. Its compatibility with existing LNG infrastructure and engine technology positions it as a practical near-term option, though scaling domestic production and addressing methane slip remain areas for further progress.
- **Batteries** are well-suited for short-range ferries and recreational vessels, offering zero TtW emissions and falling per-kWh costs. While current limitations in range, weight and lifecycle performance affect broader adoption, ongoing advancements in battery chemistry and supply chains hold promise for wider adoption (for example, coastal trading vessels).

The Department has estimated when various green fuels (and the technologies required for their use) are likely to become available for DCVs. The estimated expected timeline is shown in Figure 2. The gradient

represents the possible (light shading) to probable (dark shading) timelines for wide-scale fuel availability for the maritime sector in Australia.

The Department's analysis suggests battery, LNG, HVO and FAME (locally produced and imported) will be available soonest (and continue to grow in availability), followed by bio-LNG, e-hydrogen, e-methanol and bio-methanol, and e-ammonia. The availability of e-LNG is expected to take longer.

Most domestic vessels are small, and the energy density of most low carbon fuels is significantly lower than that of marine diesel fuel. This results in a need for more fuel storage space, posing significant challenges for vessel design and layout. However, increased bunkering (fuelling) or battery-charging frequency can improve the feasibility of low carbon fuels for vessels used on short routes, such as ferries. The safety risks associated with low carbon fuels make some of them unsuitable for certain vessel types. For example, the high toxicity of ammonia could be a challenge for use on passenger vessels.

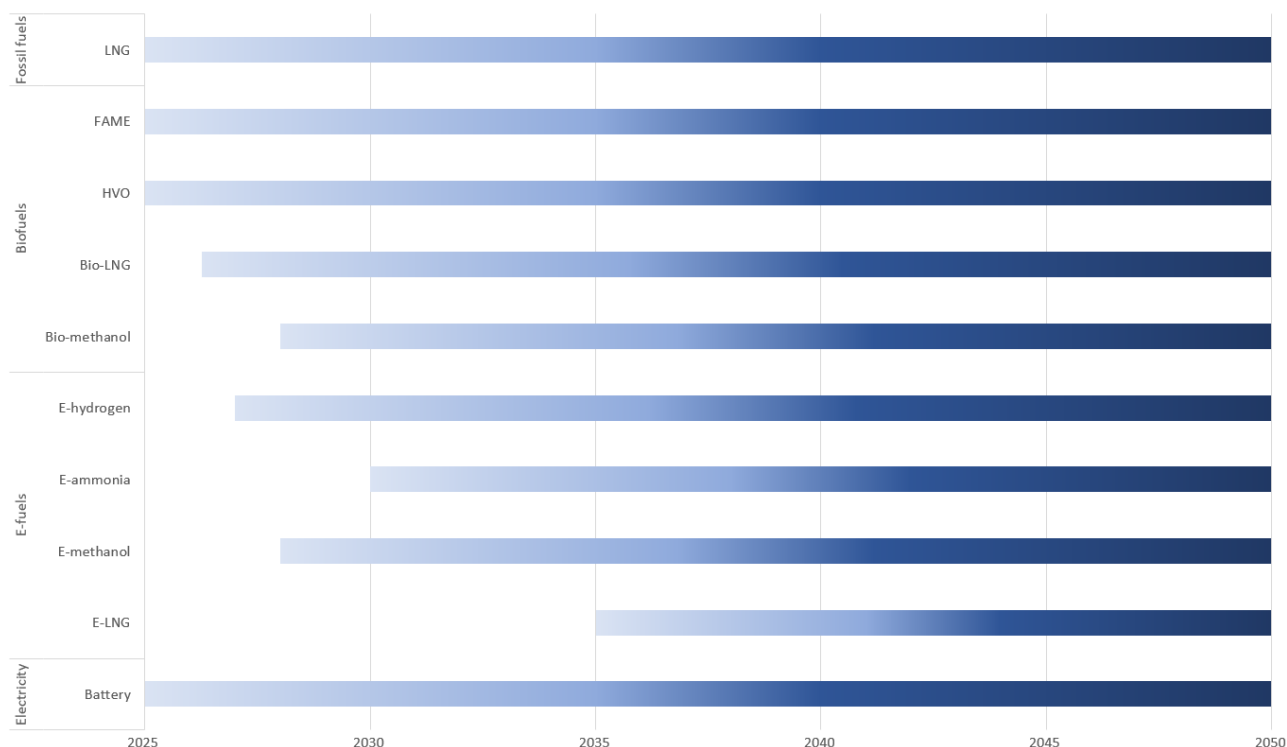


Figure 2: Estimated timeline of maritime fuel availability

Low carbon shipping for green energy exports

Australia's ambition to become a global leader in green energy exports (in particular, e-ammonia, hydrogen and e-methanol) is closely linked to decarbonising its maritime sector.

36% of global trade by sea is the carriage of energy products (Tyndall Centre for Climate Change Research 2022). Shipping will carry the new low and zero carbon energy products and volume will likely grow due to the lower energy density of these low carbon fuels. Importantly, customers globally are examining fuels from a life-cycle perspective – accounting for emissions from producing, transporting and consuming the fuels. International demand for low or zero carbon supply chains is nascent, but growing. Zero carbon cargo carriage contracts are beginning to emerge. There is growing international demand for certified low carbon fuels because robust certifications give shipowners, regulators and investors confidence that claimed climate benefits are genuine, comparable and traceable across supply chains.

Transporting green energy exports on ships powered by certified low carbon fuels will:

- reduce the carbon footprint of Australia's export activities
- meet international expectations for sustainable and low carbon supply chains, and
- strengthen Australia's position in global markets.

Further, supporting the decarbonisation of ships visiting Australia will align with and support the IMO's international maritime decarbonisation efforts, ensure the Australian maritime industry remains competitive and compliant with emerging global standards, and strengthen Australia's market position as a supplier of low carbon fuels.

Australia's energy policy

Integrating the maritime sector into Australia's national energy policy is essential to position Australia to best take advantage of the global energy transition.

The Australian Government's GO scheme provides a certification framework that tracks the production and life-cycle emissions of renewable energy and low carbon fuels, enhancing the environmental credentials of Australia's exports.

The LCLF initiative, announced in 2025 under the Future Made in Australia Innovation Fund, further supports decarbonisation across the multiple fuel sources needed by the maritime sector. Significant investment is dedicated to encouraging innovation and infrastructure development in domestic production and export of low carbon fuels such as biofuels, renewable diesel and synthetic fuels. Increased production of low carbon fuels will also directly assist decarbonisation of the maritime sector: by integrating these fuels into the maritime sector, vessel operators can reduce emissions, easing competitive pressures from other transport sectors and contribute to Australia's overall decarbonisation strategy. The Government has also announced in the 2026-27 Budget that it will introduce a market mechanism to drive demand for low carbon fuels.

Action 1.1: Support increased green energy exports

The Australian Government will further promote and support the use of low carbon fuels in shipping to reduce the carbon footprint of transporting Australia's green energy exports, including through existing programs such as the GO scheme and the acceleration of the LCLF industry under the Future Made in Australia Innovation Fund.

Through a stocktake of programs, the Department will flag the requirements of the maritime industry with relevant programs. This work will feed into the development of a bunkering strategy to help guide investment in green fuels.

Research and development

Innovation in green energy and associated technologies will be crucial for the maritime sector's contribution to Australia's commitment to achieve net zero by 2050. Government, industry and research institutions can accelerate the development and adoption of maritime decarbonisation technologies by pooling their resources and expertise.

The National Hydrogen Strategy, the LCLF initiative and other Australian Government programs provide a foundation upon which further collaborative research and development can focus on low carbon fuels and energy systems tailored to maritime applications, such as hydrogen fuel cells, advanced battery technologies and sustainable biofuels.

International collaboration, such as that exemplified by the Australia–Singapore Low-Emissions Technologies (ASLET) partnership, enhances domestic efforts by bringing global expertise and fostering shared advancements.

Australia–Singapore Low-Emissions Technologies partnership

ASLET is a collaboration between Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Maritime and Port Authority of Singapore to co-develop and deploy low emissions technologies for maritime and port operations. ASLET includes projects on low carbon fuels, electrification and digital solutions to improve energy efficiency. By sharing knowledge and resources, ASLET aims to accelerate innovation and deliver mutual economic and environmental benefits.

Collaborative investment in pilot projects and real-world demonstrations of new technologies can prove the feasibility of innovative solutions, build confidence among industry stakeholders and create pathways for commercialisation and wider adoption. By investing collaboratively in marine technology development, Australia can accelerate the transition to low emission maritime operations, strengthen the maritime sector’s competitiveness, stimulate economic growth and position us as a leader in sustainable maritime innovation.

Action 1.2: Encourage investment in research and development for maritime innovation

The Australian Government will encourage industry and research institutions to invest sustainably and collaboratively in maritime innovation by focusing on energy efficiency and the development and use of low carbon fuels. The Department will work with the Clean Energy Finance Corporation, the Australian Renewable Energy Agency and other relevant bodies, and in alignment with the National Hydrogen Strategy, to support existing resources and expertise being used to accelerate research and development of cutting-edge maritime energy technologies.

The Department will work with agencies and report back to industry. The Department will develop a maritime business case to help guide agencies.

Theme 2: Ports

Ports are critical hubs for domestic and international trade. They are integral to the development of low carbon fuel infrastructure and central to Australia's transition to low emissions shipping and green energy exports.

Private-sector port operators are already making substantial investments in infrastructure and operational efficiencies to reduce emissions. The Australian Government can support this through infrastructure upgrades, regulatory refinement and digitalisation.

Infrastructure upgrades

Widespread adoption of low carbon fuels, such as hydrogen and ammonia fuels, depends on significant investment in port infrastructure upgrades. This investment is under way and includes:

- development of storage and bunkering facilities for low carbon fuels
- decarbonising harbour-service vessels, including tugs and pilot boats
- installation of shore power infrastructure to reduce emissions from vessels at berth, and
- expansion of port energy capabilities, in the form of energy production plants and bunkering facilities, to support both domestic operations and energy exports.

Infrastructure upgrades will enable Australian ports to accommodate a diverse range of low and zero emission vessels, ensuring Australia remains competitive in a decarbonising global market.

The Australian and state and territory governments, in collaboration with industry stakeholders, will need to coordinate their investments to ensure ports have the capacity to meet the growing demands for low carbon fuels and technologies and that investment capacity is not impeded by regulatory burdens.

The modernisation of port infrastructure will drive economic growth, especially in regional areas where ports are key economic drivers. By upgrading ports to support new technologies and fuel systems, Australia can create new jobs, stimulate local economies and ensure that regional ports remain competitive in a decarbonising world.

Alongside the opportunities, the transition to low emission port operations presents some challenges. A key challenge is devising and implementing tailored approaches that ensure that all ports, regardless of size, are able to participate in decarbonisation – from large, well-resourced international gateways to smaller, regional ports with limited capacity and investment access.

Australia's ports have the chance to position themselves as global leaders in the transition to low carbon maritime operations. Through investments in green technologies and partnerships with energy producers, Australia's ports can serve as testbeds for new solutions, demonstrating the viability of low carbon fuels and creating models for other ports to follow.

Efficient operations and digitalisation

The Australian Government is helping drive digitalisation efforts and providing clear direction, offering certainty to ports as they plan their investments.

Developing low or zero emission ports involves electrifying port equipment, vehicles and machinery, connecting to renewable energy infrastructure, investing in renewable energy generation and storage, and improving energy efficiency.

Collaborative planning with energy providers and transport operations is crucial to connect ports with renewable energy fuels and ensure the use of more efficient intermodal transport networks. Enhanced port connectivity to renewable energy infrastructure will support the distribution and use of low carbon fuels. This

approach not only reduces emissions but also improves the efficiency of supply chains, contributing to economic growth and regional development.

Digital solutions can further optimise port operations and reduce emissions. As a first step, the Government is supporting decarbonisation through digitalisation by:

- developing a Maritime Single Window – a standardised platform and single portal for electronic exchange of port arrivals, stays and departures data, enabling more efficient scheduling and operations (IMO n.d.b).
- just-in-time arrival systems – a set of data-driven technologies that optimise vessel speed to ensure vessels arrive at port when waiting times will be minimal, leading to lower fuel consumption, reduced emissions, lower costs and improved efficiency.

Digitalisation technologies also provide a platform to support close monitoring and data analysis of vessels during a voyage, allowing ship and shore communication and more efficient management of vessel propulsion systems.

By transforming into low or zero emission hubs and leveraging digitalisation, Australian ports can lead by example and attract new investment. The Government is helping drive digitalisation efforts and providing clear direction, offering certainty to ports as they plan their investments.

Action 2: Enhance port infrastructure and operations to support maritime decarbonisation

The Australian Government will encourage and support investment in storage and bunkering facilities for low carbon fuels, shore power infrastructure and expansion of port energy capabilities. The Government will help drive digitalisation by providing clear direction and certainty to ports. In the first instance, the Government will consider and quantify the abatement benefits of implementing a Maritime Single Window and just-in-time arrival systems. The Government, in line with IMO mandates, is developing Australia's Maritime Single Window. Relatively low-cost energy efficiency investments can keep the maritime sector on track in reducing emissions until low carbon fuels and infrastructure reach commercial readiness.

Theme 3: Shipping

Shipping is a foundation of Australia's economy, supporting both international trade and near-coastal (domestic) transportation. Led by the IMO, international shipping is undergoing gradual decarbonisation.

Low carbon fuels and technologies in the shipping sector will support reductions in Australia's emissions footprint. The Australian Government can support decarbonisation through ongoing international engagement, which will also support the flow of benefits back to Australia.

Benefits and challenges of decarbonisation

Decarbonisation offers numerous opportunities for both domestic and international shipping. For domestic operators, benefits of adopting low emission technologies early include reduced fuel costs, enhanced operational efficiency and improved compliance with domestic and international regulations. International shipping operators stand to benefit from access to Australia's growing low carbon fuel infrastructure and its commitment to aligning with global decarbonisation efforts.

Alongside the opportunities, challenges remain, particularly in terms of the financial and logistical barriers to adopting new technologies and fuels. The Australian Government, in collaboration with industry stakeholders, will need to implement supportive policies and develop partnerships that enable the industry to address these barriers and navigate the transition effectively.

Low carbon fuels

The transition to low emission shipping requires the adoption of low carbon fuels that are both sustainable and scalable. While the use of traditional fuels, such as marine diesel oil and HFO, is still widespread, the shipping industry is beginning to explore the potential of low carbon fuels such as green ammonia and methanol. These fuels offer significant emissions reductions but require substantial infrastructure changes, including new fuel storage and bunkering facilities, as well as modifications to existing vessels.

Successfully realising Australia's ambitions to be a producer of hydrogen and other low carbon fuels will put us in a strong position to support the global shipping industry's shift towards low emission technologies. Domestic production of these fuels, coupled with investments in port infrastructure, will enable us to both support our own shipping sector's transition and supply international shipping operators with the fuels required for the global transition.

Transitional technologies

Energy efficiency technologies and applications (see Appendix 4), such as innovative propulsion technologies, are being developed to reduce the energy consumption of ships. The adoption of these technologies, alongside fuel transition, will play a vital role in reducing the emissions intensity of the shipping sector as engines that use low carbon fuels are developed and proven. Figure 3 presents a series of box plots that show the department's analysis of estimated emissions reduction potential of various maritime technologies.

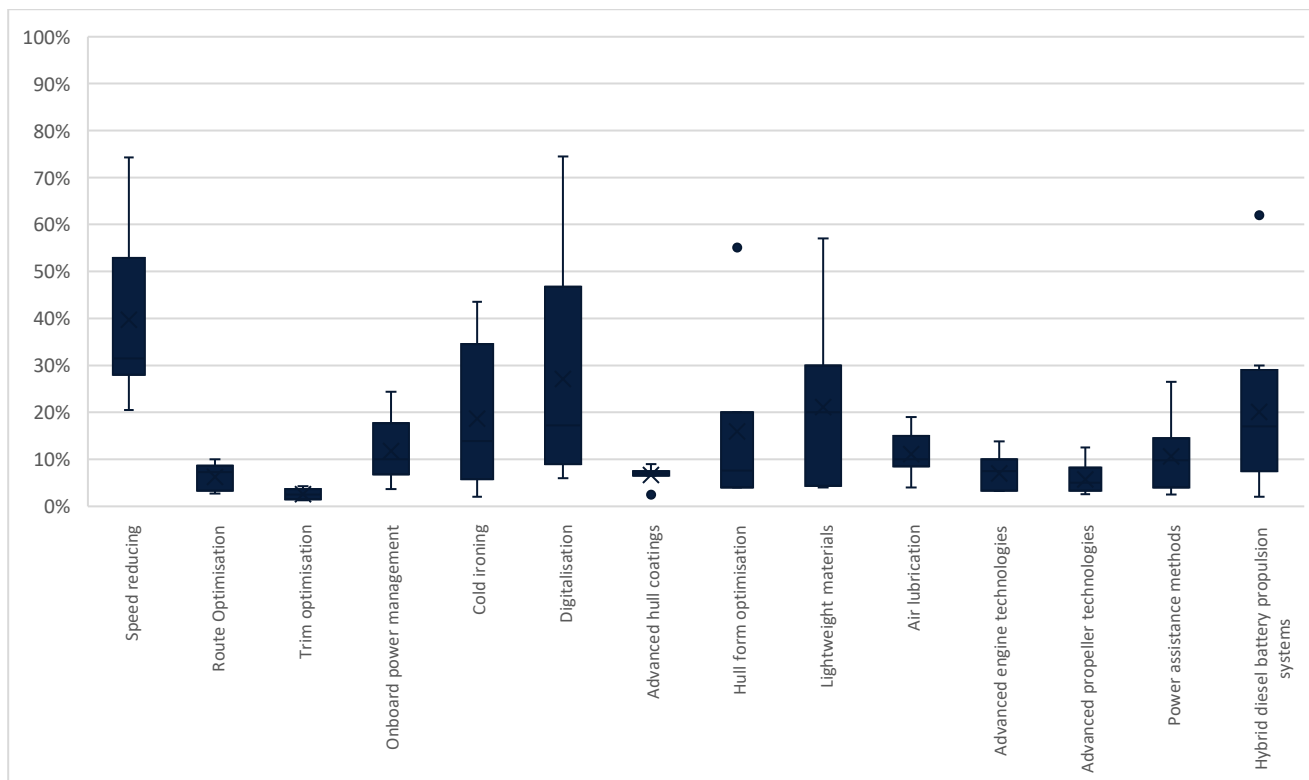


Figure 3: Estimated emissions reduction potential – maritime technologies

Technologies that reduce energy consumption are also important for the practicability of low carbon fuels. These fuels are less energy dense than fossil fuels and hence take up more volume for the same energy output. Lower energy consumption enables ships to travel further before refuelling.

There are many combinations of energy efficiencies and new fuel technologies – but all are new. Pilot scale testing, sea trials and standards development are required.

IMO engagement

The IMO sets global standards for maritime emissions reductions. Australia engages with the IMO to influence discussions, ensure opportunities for our energy exports are created and minimise negative regulatory impacts on our trade.

We aim to align our domestic shipping policies and regulatory frameworks with international regulations, especially in relation to emission reduction targets and the adoption of low carbon fuels. This ensures our shipping sector remains competitive in the global marketplace and compliant with emerging international and bilateral standards.

International shipping decarbonisation is driven by the IMO's ambition to reduce the carbon intensity of shipping by at least 40% by 2030 and achieving net zero emissions by or around 2050. To achieve these targets, shipping operators must adopt low carbon fuels, which will benefit Australia.

Expansion of green and digital shipping corridors

Green and digital shipping corridors are designated maritime routes where low carbon fuels and technologies are prioritised. They can be used to test innovative approaches and establish best practices. They present a unique opportunity for Australia to engage in decarbonisation and digitalisation efforts at an international level through partnerships with international shipping lines, ports and energy providers.

Australia's participation in the development and operation of green and digital shipping corridors can foster and support the innovation required for low emissions ships to carry our green energy exports while contributing to global knowledge of how to safely and commercially operate ships fuelled with low carbon fuels. These corridors present opportunities for Australian ports to become refuelling hubs for international vessels, further strengthening the country's position in the global maritime supply chain.

The learnings, developments and infrastructure from these collaborative efforts will also create opportunities for Australia's domestic shipping sector, including access to emerging technologies and practices that will support domestic operators' transition to low emission operations. Australia is actively engaged with Singapore and the Republic of Korea respectively on green and digital shipping corridors, with Memoranda of Understanding in place formalising cooperation. The Australian Government will continue to negotiate new green and digital shipping corridors in support of our domestic maritime decarbonisation.

Action 3: Continue IMO engagement and expand green and digital shipping corridor activities

The Australian Government will maintain engagement and participation in the IMO to influence the development of international regulations for decarbonisation. This includes accelerating the development and implementation of standards and guidelines that will facilitate the use of low carbon fuels. The Department will consult with industry and other stakeholders on its positions at the IMO. The IMO will continue to consider measures to decarbonise international shipping in 2026.

The Department will expand its involvement in green and digital shipping corridors by collaborating with international partners to trial new technologies and operational practices. These corridors serve as testbeds for new fuel efficiency technologies and low and zero emission shipping solutions, stimulate partnerships across the energy–port–shipping nexus and help develop the required future international operating standards. The Department is working with international partners including Singapore and the Republic of Korea.

- The Department is connecting Australia's maritime sector with Singapore's world-leading bunkering infrastructure and capabilities, regulatory expertise and digital systems.
- With the Republic of Korea, Australia is examining the alternative fuel supply chains, cargo trends, port infrastructure readiness and vessel requirements to decarbonise the maritime routes between both countries.

Theme 4: Domestic commercial vessels (DCVs)

The DCV sector is diverse, regionally dispersed and essential to the Australian economy. Decarbonising the DCV sector presents both significant challenges and unique opportunities, given the varying sizes, types and geographic spread of operators.

Tailored approaches are needed to ensure that DCVs, which operate across Australia's vast and diverse maritime environments, can transition to low emission technologies. The Australian Government can assist by bringing stakeholders together to build synergies and aggregate demand, and by removing regulatory barriers.

The DCV sector encompasses a wide array of vessel types and operations, each with distinct decarbonisation needs. The operational profiles and energy demands of small tourism boats, fishing vessels, ferries and other vessels used for coastal and regional transport differ from those of larger commercial vessels engaged in near-coastal shipping. Regional dispersion adds another layer of complexity. DCV operations in remote areas may have limited access to new technologies, low carbon fuels and infrastructure to support decarbonisation efforts.

Different types of maritime operation will require different pathways to decarbonisation.

- Drop-in biofuels (which offer emissions reductions without requiring major changes to vessels or fuel infrastructure) may be a natural transitional fuel – or end point – for smaller DCVs such as those used in tourism or fishing, especially where there is local supply of biofuels from the agricultural sector and/or the costs of alternative technologies are prohibitive.
- Hybrid-electric propulsion systems can reduce fuel consumption and emissions while allowing operators to continue using existing fuel sources when electric power is insufficient. This approach is especially suited to ferries and tourism vessels that operate over relatively short distances.
- Advanced low carbon fuels such as hydrogen or ammonia, along with battery electric propulsion, may be viable in the medium to longer term for larger DCVs, particularly those engaged in coastal shipping, port services or cargo transport. However, adoption of these fuels will require significant modifications to vessels and investment in new fuel storage and refuelling infrastructure at key ports. Note that the mix of options for large DCVs differs somewhat from international shipping, which may lean more heavily towards fuels such as methanol and ammonia that are better suited to long-distance travel.

DCV operators face financial challenges in adopting low emission technologies. Smaller operators often have limited capital to invest in new technologies and may lack the economies of scale available to larger operators. As such, action is required to ensure new technologies are feasible, affordable and accessible for all parts of the DCV sector.

Demand aggregation

The Australian Government will support and engage in collaboration among regional DCV operators to help develop economies of scale and minimise first-mover risk in the transition to decarbonisation.

There is a key opportunity for DCV operators with similar operational and financial capacities to collaborate on appropriate decarbonisation approaches. This is especially valuable to regional operators that may otherwise struggle with the economic feasibility of necessary infrastructure investments.

- Collaborative sector-specific prefeasibility studies can assess and chart out specific fuel or technology adoption pathways for a group of operators, such as local area marine tourism operators or a regional fishing fleet.
- Demand aggregation enables fuel and energy providers to coordinate supply to specific regions, lowering the cost of low carbon fuels and reducing barriers to entry for operators in remote or underserved areas.
- Collaboration among smaller operators can reduce first-mover risks, such as uncertainty and market retaliation, and share the costs associated with transitioning to new technologies.

Action 4.1: Support demand aggregation through collaboration among regional operators

The Australian Government will promote collaborative partnerships between regional organisations and operators to aggregate demand for low emission technologies and fuels. By bringing together groups of operators with similar needs—such as those in the tourism or fishing industries—and facilitating engagement with low carbon fuel suppliers and service providers, the Government can lower barriers to entry and improve the economic viability of infrastructure investments, especially in remote or underserved regions. This is an important step in enabling regional operators to access low emission technologies and participate in the transition.

This action will support the development of low carbon fuel supply chains, build regional capacity and create green tourism opportunities. Working with industry peak bodies, the Department will establish a forum to facilitate partnership and demand aggregation proposals.

Reduced regulatory burden

The Australian Government will explore options to streamline maritime regulatory frameworks to facilitate the deployment of new fuels and technologies in the sector while maintaining safety.

The design, construction and operation of vessels that use nonconventional technologies are regulated under AMSA's Novel Vessel Policy (AMSA 2022). These novel vessels include those that incorporate emerging technologies such as electric propulsion and installed battery power exceeding 30kWh, and vessels with alternative fuel technologies including hydrogen, ammonia, and gas-fuelled engines. The policy provides a tailored approach to these vessels to support the decarbonisation of the DCV sector while ensuring safety and environmental standards are met.

The Novel Vessel Policy requires DCV operators to seek a risk assessment from an AMSA-recognised organisation when applying for certification for new propulsion systems, including those that use low carbon fuels. These risk assessments can be costly for vessel owners and manufacturers—between \$300,000 and \$400,000—and have proven to be a disincentive for investment in decarbonisation technologies. Mitigating the cost burden of risk assessment and certification would support innovation and the domestic uptake of lower carbon marine technologies.

Decarbonisation is also hindered by the lack of uniform regulation and standards across Australia. Each state and territory have regulatory oversight of its own port and marina operations and land planning (in conjunction with local Governments). Stakeholders have highlighted the need for harmonisation across different jurisdictions to reduce uncertainty and other significant barriers to planning and investment.

Stakeholders have called for the creation of a centralised information hub where all relevant regulations and standards can be accessed. This would provide a single source of information for vessel operators, marina operators, manufacturers and energy producers. Such a hub would streamline compliance and reduce the administrative burden on industry players.

Action 4.2: Support first movers by reducing regulatory barriers and mitigating costs

The Australian Government will explore options to streamline maritime regulatory frameworks to facilitate the deployment of new fuels and technologies. A reduction in regulatory hurdles and first-mover financial burdens would support early adopters and encourage innovation to accelerate the transition to a low emission maritime industry. As a first step, the Department will work with AMSA to identify opportunities to enhance the domestic regulatory framework to better accommodate emerging vessel technologies and reduce disincentives to their development and uptake (including by narrowing the types of vessels categorised as novel vessels).

Theme 5: Skills and training

The transition to low emission technologies in the maritime sector will require a workforce with the skills and expertise to manage new fuels, systems and safety protocols. As Australia's maritime industry moves towards decarbonisation, it is essential to invest in the upskilling and reskilling of its workforce.

Investment in the upskilling and reskilling of the maritime workforce will ensure the maritime sector is ready to meet the technical and operational demands of new technologies, while maintaining high safety standards across the industry.

Maritime workforce

The adoption of low carbon fuels, advanced propulsion systems, and digitalisation will require specialised skills that are not yet widespread in Australia's maritime workforce. Engineers, operators and other maritime workers will need to be trained in the operation, maintenance and safe handling of these new systems. This is particularly important for technologies that present new risks, such as hydrogen and ammonia, which require specialised safety procedures and handling protocols.

As the Jobs and Skills Council for the transport supply chain industries including the maritime sector, ISA will play a key role in developing vocational education and training products to equip workers with these new skills. Training products must align with international standards, particularly those set by the IMO, to ensure that Australia's workforce remains competitive and compliant with global safety and operational requirements.

Regional access to training

The regional distribution of Australia's maritime workforce presents challenges in ensuring equitable access to training. Many regional and remote areas may lack the necessary training infrastructure to provide up-to-date programs on low emission technologies, which could hinder the ability of those regions to participate fully in the transition. To address these disparities, targeted investment in regional training facilities and programs is essential.

In addition to physical infrastructure, digital training platforms and remote-learning opportunities can ensure workers in remote areas have access to the same training and upskilling opportunities as those in urban centres. This will be particularly important in ensuring that all maritime operators, regardless of location, are equipped to handle the demands of new low emission technologies and maintain safety standards.

Safety focus

As the maritime sector transitions to low emission technologies, worker safety remains a top priority. Low carbon fuels involve new risks. Ensuring that all workers have undergone specialised training in the safe handling, storage and transport of these fuels is essential to protecting both the workforce and the broader community. Workers also need to be trained in the safe operation and maintenance of new propulsion systems and other advanced technologies.

By ensuring that safety training is integrated into all aspects of workforce development, Australia can ensure that the maritime sector continues to operate at the highest safety standards as it transitions to low emission technologies.

Timely and effective upskilling

The maritime skills transition is a part of wider Government and industry initiatives to address decarbonisation of Australia's economy. Ensuring Australia's vocational education and training system is providing timely and effective upskilling for the maritime sector will be key to supporting the transition. ISA stated in its *Maritime industry 2025 workforce plan* (ISA 2025) that:

Seafarers will need to be reskilled and upskilled in the safety requirements, operation and maintenance of new systems, including autonomous systems and alternative fuels, while also being trained in safety measures to protect the community, passengers and marine life...

ISA plans further research and consultation on decarbonisation policy and initiatives to identify skills and training implications for Australian seafarers. High levels of engagement and collaboration will be required between ISA, AMSA, industry and training organisations to develop training products that address these needs.

Given the diversity of technologies, fuels and approaches required to decarbonise the domestic maritime sector, skills and training approaches will vary. Nevertheless, a focus on worker safety, and harmonisation with IMO skills and training frameworks, will be central to these efforts.

Action 5: Ensure timely and effective upskilling of the maritime workforce

As the Jobs and Skills Council for the maritime sector, ISA will work with AMSA, the maritime industry and training organisations to identify and help deliver the skills and training needed to support decarbonisation of the maritime sector. This will ensure workers are prepared for the technical and operational demands of the transition, maintaining high safety standards and supporting an equitable shift to low emission maritime operations.

Conclusion and next steps

The MERNAP identifies key opportunities and actions to support the decarbonisation of Australia's maritime sector across the energy–ports–shipping nexus, the DCV sector and the workforce.

The maritime sector is critical to the national economy and global trade. The transition to low or zero carbon shipping is important to Australia's target of net zero emissions by 2050 and to facilitate the export of our renewable energy products.

Developed through extensive consultation with industry stakeholders, Government agencies and international partners, the MERNAP has highlighted the interconnected nature of the energy–port–shipping nexus. It reinforces the importance of a holistic approach to decarbonisation, in which advancements in one area support and enhance progress in others.

The consultations, supported by research, have identified seven action areas across the energy–port–shipping nexus, the DCV sector and the workforce. Some of these require significant investment over time, but others are low cost and foundational to supporting the sector's transition to a zero carbon future.

Action 1.1: Support increased green energy exports

Action 1.2: Encourage investment in research and development for maritime innovation

Action 2: Enhance port infrastructure and operations to support maritime decarbonisation

Action 3: Continue IMO engagement and expand green and digital shipping corridor activities

Action 4.1: Support demand aggregation through collaboration among regional operators

Action 4.2: Support first movers by reducing regulatory barriers and mitigating costs

Action 5: Ensure timely and effective upskilling of the maritime workforce

Moving forward

The successful implementation of these actions hinges on robust coordination and collaboration across all levels of government and industry. Establishing a coordination mechanism within the Department will centralise efforts, facilitate communication and ensure alignment of policies and initiatives across the energy–port–shipping nexus. A coordination function supporting the Infrastructure and Transport Ministers' Meeting can be a single source of maritime decarbonisation information, oversee the implementation of initiatives, monitor progress, and adapt strategies as needed to respond to technological advancements and market developments. This mechanism can take advantage of the existing decarbonisation working group that sits under the Infrastructure and Transport Ministers' Meeting, and will support informed decision-making and policy development across the Australian and state and territory governments.

Appendix 1: Consultative group – terms of reference

The Maritime Emissions Reduction National Action Plan (MERNAP) Consultative Group is established to oversee the co-design and development of the MERNAP, in collaboration with government and key industry stakeholders. The Consultative Group will play a critical role in shaping the MERNAP, ensuring that it is aligned with the Australian Government's objectives for emissions reduction and decarbonisation in the maritime sector.

The Consultative Group will:

- provide strategic guidance and advice on the development of the MERNAP
- review and provide feedback on issues papers
- collaborate with government and industry partners in research and analysis efforts
- ensure the MERNAP addresses the unique needs and opportunities of Australia's maritime sector
- facilitate engagement with broader stakeholder groups for consultation and feedback
- oversee the development of Key Performance Indicators for the MERNAP.

Composition

The Consultative Group will be composed of key representatives from:

- the Australian Government, including relevant Departments and agencies
- industry, encompassing various segments such as shipping, ports, marine services and energy
- academia, with expertise in maritime emissions reduction, decarbonisation technologies and policy development.

The composition of the Consultative Group should ensure diverse perspectives and expertise in the maritime sector. Membership should be reviewed periodically to maintain relevance and representation.

Co-design principles

The Consultative Group will adhere to best practice co-design principles, including:

- inclusivity – ensuring diverse representation and active participation from all stakeholders
- transparency – openly sharing information on progress and decision-making processes
- collaboration – fostering a culture of trust, mutual respect and shared responsibility
- flexibility – adapting to new insights, ideas and feedback
- iterative learning – encouraging continuous improvement and learning.

Meetings and decision-making

The Consultative Group will meet regularly throughout the development of the MERNAP, with a proposed schedule to be determined at the first meeting. Meetings will provide an opportunity for members to discuss, provide feedback and iterate on the issues papers and MERNAP components. Decision-making will be consensus-based, with any disputes resolved through open dialogue and collaboration.

Responsibilities

Consultative Group members are expected to:

- actively contribute to the development of the MERNAP by providing input, expertise and feedback
- collaborate with other members to identify focus areas, best practices and innovative approaches
- participate in Consultative Group meetings and broader stakeholder consultations
- promote the MERNAP within their respective organisations and networks
- monitor and review the progress and effectiveness of the MERNAP once implemented.

Proposed tools and approaches

The Consultative Group can use various activities and tools to facilitate the development of the MERNAP. These will be discussed and determined during the first meeting. Some options include:

- workshops – organise workshops with subject matter experts and stakeholders to brainstorm ideas, discuss challenges, and identify opportunities for emissions reduction in the maritime sector
- scenario planning – develop and analyse different future scenarios to explore the potential impacts of various decarbonisation technologies, policies and strategies on the maritime sector
- stakeholder mapping – identify and map key stakeholders in the maritime emissions reduction landscape, ensuring that all relevant perspectives are included in the development process
- surveys and questionnaires – collect input and feedback from a broader range of stakeholders through surveys and questionnaires, allowing for the integration of diverse viewpoints into the MERNAP
- online collaboration platforms – utilise online collaboration tools and platforms to facilitate communication, document sharing and project management among Consultative Group members and other stakeholders
- benchmarking – study best practices and successful initiatives from other countries and sectors to gain insights and inspiration for the development of the MERNAP
- pilot projects – implement and evaluate pilot projects to test the feasibility and effectiveness of proposed emission reduction strategies and technologies before incorporating them into the MERNAP
- expert panels – invite external experts to present on specific topics related to maritime emissions reduction, providing valuable insights and knowledge to inform the development of the MERNAP
- monitoring and evaluation framework – develop a comprehensive framework to track the progress and impact of the MERNAP once implemented, allowing for ongoing assessment and adaptation as needed.

Subgroups and working groups

To facilitate the co-design process and address specific focus areas, particularly through the issues papers, the Consultative Group may establish subgroups or working groups, drawing on the expertise of members and external experts as needed. These subgroups or working groups will report back to the Consultative Group and contribute to the development of the MERNAP.

Secretariat

The Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts will provide all secretariat services, including to:

- convene the meetings of members (either in-person or online)
- convene subgroups, as required and identified by the Consultative Group
- provide regular updates for members and access to new information about technological and policy developments domestically and internationally
- consider procuring relevant studies
- develop all key documents for consideration, including scoping paper, terms of reference, issues papers and consultation papers
- send out documents for review and input
- develop the draft and final MERNAP document, based on input from the Consultative Group
- undertake media and communications activities as required.

Appendix 2: Development of the MERNAP

The MERNAP Consultative Group:

- provided strategic guidance and advice on the development of the MERNAP
- reviewed and provided feedback on issues papers
- collaborated with government and industry partners in research and analysis efforts
- ensured the MERNAP addressed the unique needs and opportunities of Australia's maritime sector
- facilitated engagement with broader stakeholder groups for consultation and feedback.

In addition to the Consultative Group, the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts undertook extensive consultation with industry through forums, such as the Maritime Industry Australia Ltd Decarbonisation Summit and the Boating Industry Association Boat Show, and one-on-one meetings with industry stakeholders.

To inform the development of the MERNAP, the Department published a series of issues papers on a range of maritime decarbonisation topics for public consultation (DITRDCA n.d.):

- Issues paper 1: Regulation and standards
 - Consultation closed 22 September 2023
 - Received 18 submissions
- Issues paper 2: Energy sources and technologies
 - Consultation closed 2 February 2024
 - Received 12 submissions
- Issues paper 3: Skills and training
 - Consultation closed 12 March 2024
 - Received 8 submissions
- Issues Paper 4: Green shipping corridors and partnerships
 - Consultation closed 5 April 2024
 - Received 10 submissions

The findings from these consultation papers are presented throughout this document.

Appendix 3: Current Australian Government initiatives

The Australian Government has implemented incentives and policies to support the maritime decarbonisation transition and the development of low carbon energy sources, including biofuels and e-fuels (e-hydrogen, e-ammonia, e-methanol), and investment in hydrogen hubs. Government and private-sector investments in low emission energy sources are increasing.

Australia-Singapore Low-Emissions Technologies (ASLET) Initiative for Maritime and Port Operations

ASLET is a bilateral program designed to accelerate Australia and Singapore's maritime and port sectors towards a low carbon future. Both Singapore and Australia have committed up to \$10 million each in their respective currencies to deliver projects under the initiative. ASLET has provided funding to support applied research, pilot and demonstration projects that will contribute to reduced cost, increased safety and accelerated update of low emission technologies for maritime and port operations. The initiative seeks to fund solutions that make use of technology from either Australia or Singapore and brings equitable benefit to both countries.

Australian Regional Hydrogen Hubs program

The Australian Government has committed up to \$500 million to support the development of regional hydrogen hubs.

This will help identify opportunities, lower hydrogen production costs, encourage innovation, and build local workforce capability, positioning Australia as a global hydrogen leader. Hydrogen Hub implementation projects are being supported in the Pilbara and Kwinana in Western Australia, Bell Bay in Tasmania, the Hunter Valley in New South Wales, and Port Bonython in South Australia. Like other emerging industries, early projects face challenges and some projects have been discontinued. Continued support will allow ongoing projects to reduce costs over time and be ready for when hydrogen demand, including potentially shipping, increases.

Clean Energy Finance Corporation (CEFC)

The Clean Energy Finance Corporation (CEFC) has established a \$300 million Advancing Hydrogen Fund to back projects aligned with Australian Government strategies, particularly the National Hydrogen Strategy and the development of regional hydrogen hubs. The CEFC Investment Mandate also requires the Board to make available \$500 million through the Powering Australia Technology Fund for investment in climate tech opportunities which facilitate the development, commercialisation or take up of clean energy technologies.

Cleaner Fuels Program

On 17 September 2025, the Australian Government announced a new \$1.1 billion Cleaner Fuels Program to encourage domestic production of LCLF, while strengthening fuel security and supporting new jobs in the net zero economy. Working with industry, the Government will also introduce a demand measure that provides certainty for new Australian LCLF production and stimulates investment in new, clean fuel refining capacity. This will reduce Australia's reliance on imported fuels, improving the resilience of our domestic transport industry. On 18 August 2026, DITRDCSA and the Department of Climate Change, Energy, the Environment and Water released a joint consultation paper, *Securing Australia's Cleaner Fuels Industry*, seeking stakeholder views on options to support greater use of LCLF in Australia. Feedback from industry, governments and other stakeholders will be used to inform the next stage of policy development and future government decisions. Consultation closes on 15 September 2026.

Future Made in Australia Innovation Fund – low carbon liquid fuels

The Australian Government's Future Made in Australia plan, backed by a \$22.7 billion investment over the next decade, is designed to maximise the economic and industrial benefits of this transition (Treasury 2024). It aims to strengthen priority supply chains and become an essential player in the clean energy industries that will define the future global economy. In this manner, it includes the \$250 million to unlock the nation's potential in the production and export of LCLFs, which is part of the \$1.5 billion Future Made in Australia Innovation Fund. This package is designed to support the development of technologies and infrastructure necessary for the widespread adoption of LCLFs, which include biofuels, renewable diesel, synthetic fuels, and other advanced liquid fuels that have a significantly lower carbon footprint than traditional fossil fuels.

As part of this initiative, the Government is focusing on creating a conducive environment for innovation and investment in LCLF technologies. This includes streamlining regulatory approvals and providing incentives for the construction of production facilities. In its 2024–25 Budget, the Government announced a number of measures to support a domestic LCLF industry, including \$18.5 million over 4 years to develop a certification scheme for these fuels. The package also aims to ensure that Australia can meet both domestic energy needs and international demand for LCLFs, positioning the country as a leader in the global energy transition.

Guarantee of Origin (GO) scheme

To support the integrity and traceability of domestically produced low carbon fuels, the Australian Government is implementing the GO scheme. This scheme provides a voluntary framework that certifies the production and delivery emissions of low carbon products, including hydrogen and LCLFs. The GO scheme will support development of Australia's LCLF industry, providing buyers with transparent and trusted information on the low carbon credentials of the fuels they purchase and supporting producers to attain green premiums. This certification will help bolster Australia's reputation as a trusted supplier of genuine low carbon products in the global market.

International partners

The Australian Government is working closely with international partners (including Germany, Japan, the Republic of Korea, China, the United States of America, the United Kingdom, Singapore, India, and the Netherlands) to advance action on climate change and build new clean energy industries, particularly for green hydrogen and its derivatives (DCCEEW 2025). These partnerships include agreements for Australia to supply hydrogen and its derivatives in the future, and the Government has engaged with partner countries in discussions on several international green and digital shipping corridor initiatives. These are practical collaborative mechanisms to demonstrate low and zero emission vessels and fuel supply chains, accelerating their uptake.

Investment in Hydrogen through the Australian Renewable Energy Agency (ARENA)

ARENA is playing a central role in supporting Australia's hydrogen industry through significant investments in renewable hydrogen projects. Under its first round of large-scale funding under the Hydrogen Headstart program, the Australian Government through ARENA committed \$1.25 billion, including \$814 million to Copenhagen Infrastructure Partners' 1,500 MW Murchison Green Hydrogen Project in Western Australia and \$432 million to Orica's Hunter Valley Hydrogen Hub. Both projects will support production of decarbonised ammonia, with ammonia produced by the Murchison project potentially to be used in maritime decarbonisation. The Government has confirmed \$1 billion will be available for the second round of funding and ARENA has announced a shortlist of seven projects. ARENA has also committed over \$396 million across 68 renewable hydrogen projects, ranging from early-stage research to trials and deployment initiatives.

Maritime Fuel Resilience and Decarbonisation

Announced in Budget 2026-27, the Australian Government is investing \$4 million to develop a green fuel bunkering strategy, to prepare Australian ports to diversify the maritime fuel mix, supported by targeted industry trials and studies. It will help secure long-term resilience for the industry that carries more than 99% of Australia's trade by volume.

Maritime Single Window

Also announced in Budget 2026-27, the Australian Government has committed \$47.1 million to continue development of a Maritime Single Window and establish a digital port for international maritime regulatory reporting. Making it easier for people and goods to move by sea, through reducing disruptions caused by inefficient administrative processes in arrival and departure reporting, is critical to improving maritime sector productivity. This commitment builds on the \$4.6 million already invested in the design of a Maritime Single Window to meet the needs of industry and government and brings the total investment on the Maritime Single Window to \$51.7 million.

Maritime Skills and Training Package

A \$16.9 million maritime skills and training initiative will give up to 20 trainee seafarers each year, for four years, access to berths to complete sea time required for international certification. This will support the Australian Government's maritime Strategic Fleet and the broader industry. \$2.5 million will also flow to the Transport and Logistics Jobs and Skills Council (JSC) to address training barriers, and ultimately Australia's maritime skills shortage.

National Hydrogen Strategy

The National Hydrogen Strategy, released in 2019 and comprehensively updated in 2024, aims to build a clean, innovative, safe and competitive hydrogen industry that benefits Australia's communities and economy, enables the net zero transition and positions Australia as a global hydrogen leader.

- The Strategy, which was endorsed by all Australian states and territories who are collectively responsible for delivering its 34 actions against four broader objectives:
 - Supply: the hydrogen industry supplies hydrogen that is globally cost competitive.
 - Demand and decarbonisation: activating the most prospective domestic demand sectors for hydrogen-based decarbonisation.
 - Community benefit: communities are aware of and can realise the benefits of hydrogen.
 - Trade, investment and partnerships: establish trade at scale and leverage purposeful partnerships.

Australia's hydrogen pipeline represents around \$160-200 billion in investment, and there are more than 50 companies progressing hydrogen projects in Australia.

National Reconstruction Fund Corporation

The Australian Government established the National Reconstruction Fund Corporation (NRFC) to support priority areas of the Australian economy. The NRFC can provide finance in the form of debt, equity and guarantees to support Australian projects that drive high-value industry transformation.

The NRFC also administers the Net Zero Fund, announced as part of the Government's approach to driving decarbonisation, unlocking new manufacturing investment, and improving energy affordability in hard-to-abate sectors of the Australian economy. The fund has been designed to:

- support large industrial firms to decarbonise energy-intensive parts of their operations, and
- support investment in the scale-up of domestic manufacturing of low emissions technologies.

Private-sector initiatives

The Australian business sector has several measures to reduce maritime emissions, including investing in the scaling up of renewable fuels production, developing low emission maritime technologies and their enabling infrastructure, and designing and building low emissions vessels. Several partnerships between international companies to establish specific green corridors are in place, such as the Global Maritime Forum's Australia-East Asia Iron ore Green Corridor (GMF, 2024). Moreover, the private sector is establishing multisectoral collaborative platforms and key stakeholder networks to share information and improve strategic coordination to decarbonise the maritime sector. In the fishing industry, the adoption of sustainable fishing practices, including converting to more efficient and less fuel intensive fishing vessels is occurring.

Safeguard Mechanism

The Safeguard Mechanism is the Australian Government's key policy for reducing industrial emissions and applies to facilities emitting more than 100,000 tonnes of Scope 1 CO₂-e per year. It drives emissions reductions from Australia's largest industrial facilities in line with Australia's national emissions reduction targets of 43% below 2005 levels by 2030 and net zero by 2050. The mechanism covers emissions across four sectors, including the transport sector.

Safeguard Mechanism facilities are required to meet their declining emission limits or baselines. If baselines are exceeded, facilities must manage excess emissions by purchasing and surrendering Australian Carbon Credit Units or Safeguard Mechanism Credit (SMCs) units. If facilities' emissions are below their baseline, facilities can generate SMCs which can be either sold to other Safeguard facilities or kept for future use.

The Safeguard Mechanism provides a range of flexible compliance options for facilities to meet their obligations. In addition to purchasing domestic offsets and credits, compliance options include:

- applying to borrow up to 10% of a facility's baseline from the following year (to be repaid with a 10% interest)
- applying to secure a trade-exposed baseline-adjusted facility status and receive a discounted baseline decline rate (for up to 3 years)
- applying for a five-year multi-year monitoring period to allow facilities, with excess emissions and a credible plan to undertake abatement, time to reduce emissions before the end of the five-year period, and
- a cost containment measure to provide certainty to facilities on the maximum compliance costs.

Strengthening Supply Chains and Relieving Pressure on Fuel Users

Through Budget 2026-27, the Australian Government is delivering a fuel security and price relief package, including \$55 million for a Transport Resilience and Capacity Kickstart pilot program to incentivise more freight to move via trains and cargo ships.

Appendix 4: Energy efficiency technologies

The viable energy efficiency technologies can be divided into two categories, operational methods, and technical methods as below:

- Operational methods
 - Speed reducing
 - Route optimisation
 - Trim optimisation
 - Onboard power management
 - Cold ironing
 - Digitalisation
- Technical methods
 - Advanced hull coatings
 - Hull form optimisation
 - Lightweight materials
 - Air lubrication
 - Advanced engine technologies
 - Advanced propeller technologies
 - Power assistance methods
 - Hybrid diesel battery propulsion systems

Speed reducing: Reducing speed, also known as slow steaming, is an effective measure to reduce fuel consumptions in maritime transport, however, it increases travel time.

Route optimisation: Environmental factors, such as wind speed and direction, water speed and depth, can influence fuel consumption of vessels. Route optimisation methods enable ship operators save fuels.

Trim optimisation: Trim optimisation is a way to reduce the ship resistance against the vessel's motion. It depends on several factors like the loading conditions, the speed of the vessel, the draft, the power of the main engine, and wind speed and direction. Thus, this method functions in conjunction with speed reducing and route selection.

Onboard power management: There are primarily two approaches to optimising onboard power consumption. The first involves implementing automatic power management systems that utilise automation to conserve power efficiently. The second approach entails the adoption of best practices and management guidelines to reduce power consumption effectively.

Cold ironing: Cold ironing, also known as shore power, is the process of providing electrical power from the shore to a vessel while she is docked, thereby allowing a vessel's auxiliary engines to be turned off to reduce emissions.

Digitalisation: Digitalisation technologies, such as the Internet of Things (IoT), Artificial Intelligence (AI), and autonomous shipping, have the potential to enhance the efficiency of supply chains and shipping, ultimately leading to reduced fuel consumptions. The Maritime Single Window to be implemented is an example of digitalisation.

Advanced hull coatings: Surface roughness, caused by both physical imperfections and the accumulation of biological growth, has a significant effect on frictional resistance for a vessel's hull. Advanced hull coatings can reduce drag and, as a result, save fuels.

Hull form optimisation: Designing a hull using advanced optimisation methods can produce the most efficient form within the requirements of the vessel design and minimise resistance to save fuels.

Lightweight materials: Some lightweight materials, like aluminium and glass reinforced plastic, can be used on vessels to reduce their light weights, resulting in saving fuels.

Air lubrication: Air lubrication systems can decrease frictional resistance by generating a layer of microbubbles across the entire flat surface of a vessel's hull, thereby reducing fuel consumption.

Advanced engine technologies: Some advanced engine technologies, such as enhanced fuel injection systems and waste heat recovery systems can help reduce energy consumptions.

Advanced propeller technologies: Some advanced propeller technologies, such as contra-rotating propellers (CRP), podded propulsor propeller (POD), propeller ducts, pre-swirl stators, post-swirl fins and rudder bulbs, can offset the swirls generated by propellers, and thus improves propulsion efficiency to save fuels.

Power assistance methods: Onboard power assistance approaches, like wind assistance such as Flettner rotors, towing kites, and sails, and solar assistance (solar panels), can reduce vessels' fuel consumptions.

Hybrid diesel battery propulsion systems: The hybrid systems store the energy produced by the diesel engines during lighter loads and releases it under heavy loads of vessels. This reduces the fuel requirement of the engines and allows it to operate constantly at maximum efficiency.

References

- AMSA (Australian Maritime Safety Authority) (2022) '[Novel vessels](#)', National standards for commercial vessels, AMSA website, accessed 15 May 2026.
- (2024) [Australian Maritime Safety Authority corporate plan 2024–25](#), AMSA, accessed 15 May 2026.
- (n.d.) [Women in maritime | Australian Maritime Safety Authority](#), Women in maritime, AMSA website, accessed 15 May 2026.
- BITRE (Bureau of Infrastructure and Transport Research Economics) (2014) [Ports: job generation in the context of regional development](#), accessed 15 May 2026.
- (2023) [Australian Sea Freight 2020–21](#), BITRE, accessed 15 May 2026.
- (2025) [Australian Sea Freight 2023–24](#), BITRE, accessed 15 May 2026.
- DCCEEW (Department of Climate Change, Energy, the Environment and Water) (2022) [State of hydrogen 2022](#), DCCEEW, accessed 15 May 2026.
- (2024a) [Growing Australia's hydrogen industry](#), DCCEEW website, accessed 15 May 2026.
- (2024b) [Powering Australia](#), DCCEEW website, accessed 15 May 2026.
- (2025) [Australia's international climate and clean energy partnerships](#), DCCEEW website, accessed 15 May 2026.
- DITRDCSA (Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts) (n.d.) [Charting Australia's Maritime Emissions Reductions | Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts](#), DITRDCSA website, accessed 15 May 2026.
- GMF (Global Maritime Forum) (2024) [Supporting the establishment of the Australia-East Asia iron ore green corridor | Global Maritime Forum](#), GMF website, accessed 15 May 2026.
- IMO (International Maritime Organization) (2023) [2023 IMO strategy on reduction of GHG emissions from ships](#), IMO website, accessed 15 May 2026.
- (n.d.a) [IMO's work to cut GHG emissions from ships](#), IMO website, accessed 15 May 2026.
- (n.d.b) [Maritime Single Window](#), IMO website, accessed 15 May 2026.
- ISA (Industry Skills Australia) (2023) [Maritime industry 2023 initial workforce plan](#), ISA, accessed 15 May 2026.
- (2025) [Maritime industry 2025 workforce plan](#), ISA, accessed 15 May 2026.
- Marina Industries Association (2023), [Health of the marina industry survey 2023 summary fact sheet](#), Marina Industries Association, accessed 15 May 2026.
- Ports Australia (2024) [State of trade 2024](#), Ports Australia, accessed 15 May 2026.
- Strategic Fleet Taskforce (2023) '[Strategic Fleet Taskforce, meeting 10](#)', accessed 15 May 2026.
- Treasury (2024) [A future made in Australia, Budget 2024–25 factsheet](#), accessed 15 May 2026.
- Tyndall Centre for Climate Change Research (2022) [Shipping's role in the global energy transition](#), report to the International Chamber of Shipping, accessed 15 May 2026.