MINISTRY OF TRANSPORT
MALAYSIA

GREEN BUNKERING
REGULATORY ROADMAP



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This Roadmap is a policy publication of the Government of Malaysia through the Ministry of Transport Malaysia. It has been approved by the Cabinet of Malaysia and sets out the Government's policy direction and implementation priorities for green bunkering. Its development was supported by the Government of Australia through Partnerships for Infrastructure (P4I), an Australian Government initiative. The policy directions and positions expressed in this Roadmap are those of the Government of Malaysia.

Implementation will be led by MOT in coordination with the relevant ministries, agencies, port authorities and industry stakeholders, in accordance with their statutory mandates and applicable laws, regulations, financial procedures and administrative arrangements. Where an action requires new or amended legislation, subsidiary legislation, fiscal measures or institutional arrangements, the responsible authority will carry it forward through the applicable Government and legislative processes.

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The Ministry also acknowledges the technical and legal expertise mobilised through P4I, as well as the valuable inputs received from the Malaysia Marine Department (MMD), port authorities, relevant Federal Ministries and agencies, port operators, fuel producers and suppliers, shipping lines, industry associations, technical experts and other stakeholders.

Special appreciation is extended to participants in the stakeholder validation workshop held in Kuala Lumpur on 3 October 2025, whose inputs helped refine and prioritise the actions contained in this Roadmap.

This Roadmap reflects Malaysia's commitment to strengthening a safe, competitive, sustainable and internationally aligned regulatory environment for green bunkering, while further reinforcing the longstanding partnership between Malaysia and Australia in advancing sustainable infrastructure and maritime decarbonisation.



Photo courtesy of MASA

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FOREWORD



Malaysia has long been shaped by the sea. Our strategic location along one of the world's most important maritime corridors has enabled our ports, shipping services and maritime industries to contribute significantly to national growth and regional connectivity. As international shipping enters a new era of decarbonisation, Malaysia must ensure that its maritime sector remains safe, competitive, resilient and ready for the fuels and technologies of the future.

The Green Bunkering Regulatory Roadmap, approved by the Cabinet of Malaysia, sets out Malaysia's policy direction for building the regulatory foundations needed to support low- and zero-greenhouse-gas marine fuels. It recognises that the transition will not be driven by a single fuel or technology. Rather, it requires an adaptive regulatory framework that protects safety and the environment, provides certainty to investors and operators, strengthens port readiness, develops national capabilities and remains aligned with evolving international standards.

The Roadmap therefore focuses on practical priorities: clearer institutional responsibilities, more efficient licensing and approval processes, internationally aligned safety standards, investment and infrastructure enablers, robust procedures for simultaneous operations, workforce readiness, responsible-transition outcomes, and a longer-term review of Malaysia's legislative architecture for clean and low-GHG fuels.

Malaysia's approach is anchored in our national energy transition and maritime development priorities, while recognising the importance of the International Maritime Organization, ASEAN cooperation and the changing requirements of global shipping markets. We will continue to engage constructively at the international level and ensure that domestic policy remains responsive to technological, commercial and regulatory developments.

I also wish to acknowledge the Government of Australia, the Australian High Commission, Malaysia and Partnerships for Infrastructure (P4I) for their support in the development of this Roadmap, together with the many Malaysian ministries, agencies, port authorities and industry stakeholders that contributed their expertise and operational experience.

Through coordinated implementation, Malaysia can strengthen its position as a leading maritime and bunkering hub in the Asia-Pacific region while supporting a safe, inclusive and sustainable transition for our maritime industry.

YB LOKE SIEW FOOK
Minister of Transport Malaysia

PREFACE

The Green Bunkering Regulatory Roadmap translates Malaysia's strategic ambition into a structured programme of regulatory, institutional and operational actions. Following its approval by the Cabinet of Malaysia, the focus now shifts to coordinated implementation across the relevant ministries, agencies, port authorities and industry. The Roadmap was developed following regulatory analysis, stakeholder engagement and the earlier feasibility work undertaken by the Ministry of Transport Malaysia (MOT) with Partnerships for Infrastructure (P4I) on low-carbon bunkering at the Port of Tanjung Pelepas.

The Roadmap is intended to provide a common direction for government agencies, port authorities and industry as Malaysia progressively develops the regulatory ecosystem for alternative marine fuels. Its implementation will require close coordination across transport, energy, industry, environment, occupational safety, trade, customs, finance, State and local authorities, together with active participation by ports, fuel suppliers, shipping lines and other private-sector stakeholders.

The policy horizon is organised into short-term actions for 2026-2027, medium-term actions for 2028-2029 and longer-term actions from 2030 onwards. These timeframes will be reviewed periodically to reflect changes in technology, fuel availability, market demand, international requirements and Malaysia's own policy and legislative developments.

Implementation will be guided by five principles: safety first; regulatory clarity and efficiency; lifecycle emissions integrity; investment and market readiness; and a responsible transition that supports skills, inclusion, resilience and equitable outcomes. MOT will coordinate periodic review of the Roadmap and work with the responsible authorities to translate the approved actions into specific regulatory instruments, operating procedures, capacity-building programmes and investment-enabling measures.

I record my appreciation to all agencies and stakeholders that contributed to this work and to the Government of Australia and P4I for their partnership and technical support.



DATO' SERI JANA SANTHIRAN MUNIAYAN
Secretary General
Ministry of Transport Malaysia

ABBREVIATIONS & ACRONYMS

AMS	ASEAN Member States
AMSA	Australian Maritime Safety Authority
APAD	Land Public Transport Agency (Agensi Pengangkutan Awam Darat)
APM	APM Terminals
ASEAN	Association of Southeast Asian Nations
ASLET	Australia-Singapore Low-Emissions Technologies Initiative
ATM	ASEAN Transport Ministers Meeting
CARES	Coordinated Actions to Reduce Emissions from Shipping
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DOSM	Department of Occupational Safety and Health
DPKK	National Carbon Market Policy (Dasar Pasaran Karbon Kebangsaan)
DRRCC	Disaster Risk Reduction and Climate Change
DSL	Domestic Shipping License
EEA	EU/European Economic Area
EIA	Environmental Impact Assessment
EQA	Environmental Quality Act
EU	European Union
FFT	Future Fuels and Technology
GEN	Green and Efficient Navigation
GHG	Greenhouse Gas
GPS	Global Ports Safety
GSS	Green Ship Strategy
IAPH	International Association of Ports and Harbors
ICA	Industrial Co-ordination Act
IGF	International Code of Safety for Ships using Gases or other Low-flashpoint Fuels
IMO	International Maritime Organization
JPA	Johor Port Authority (Lembaga Pelabuhan Johor)
KPI	Key Performance Indicators
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Marine Environment Protection Committee
MJTTF	Maritime Just Transition Taskforce
MMD	Malaysia Marine Department
MOT	Ministry of Transport Malaysia
MPA	Maritime and Port Authority of Singapore
MSC	Maritime Safety Committee
MSN	Malaysia Shipping Notice
MTWG	Maritime Transport Working Group
NDC	Nationally Determined Contribution
NETR	National Energy Transition Roadmap
NZF	Net-Zero Framework
OPS	Onshore Power Supply
P4I	Partnerships for Infrastructure
PDA	Petroleum Development Act
PETRONAS	Petroliam Nasional Berhad
PETROS	Petroleum Sarawak Berhad
PTP	Port of Tanjung Pelepas
RUUPIN	National Climate Change Bil (Rang Undang-Undang Perubahan Iklim Negara)
SIMOPS	Simultaneous Operations
SOE	State-Owned Enterprise
SOLAS	Safety of Life at Sea
SOP	Standard Operating Procedure
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

International shipping is undergoing a fundamental transition as governments, ports, fuel suppliers and shipping companies respond to increasingly stringent greenhouse-gas (GHG), safety and energy requirements. Malaysia is strategically positioned to strengthen its role as a regional bunkering and maritime hub, but this opportunity depends on a regulatory environment that is clear, safe, investment-ready and able to adapt to rapidly evolving fuels, technologies and international standards. This Roadmap sets out Malaysia's policy direction for strengthening that environment, in alignment with national energy-transition priorities and the principles of a responsible transition.

Green Bunkering

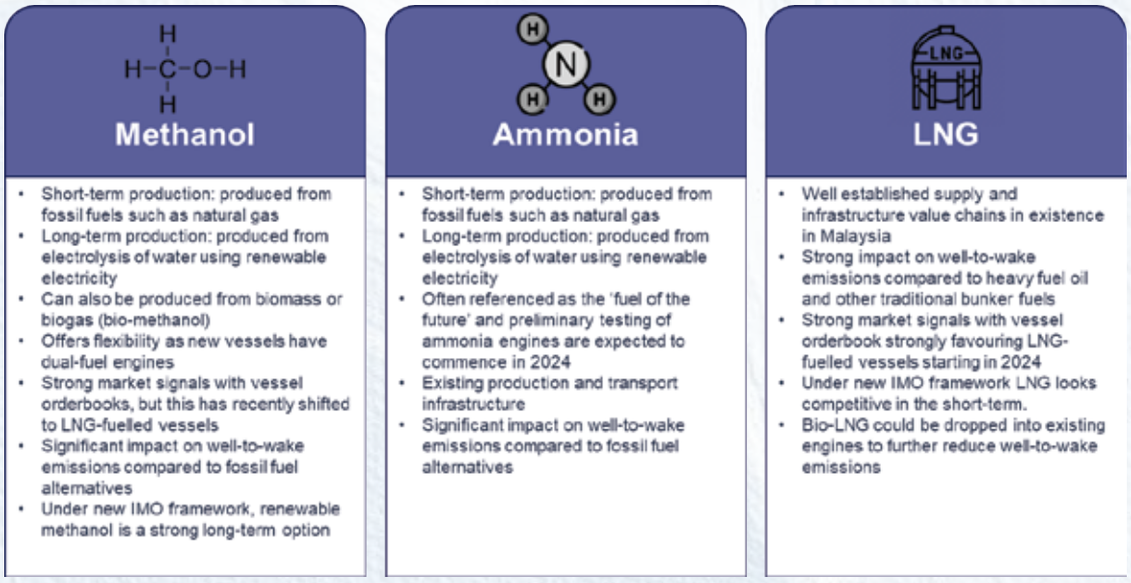
For the purpose of this Roadmap, green bunkering refers to the safe supply and transfer of marine fuels and energy carriers that can deliver demonstrable reductions in GHG emissions on a lifecycle, well-to-wake basis, consistent with applicable national requirements and internationally recognised standards and methodologies. Fuels and energy carriers considered under the Roadmap may include low- and zero-GHG methanol, ammonia, biofuels, LNG and its renewable or synthetic derivatives, hydrogen and other emerging options, subject to their lifecycle emissions performance, safety requirements, technological maturity and commercial viability.

- **Lifecycle Environmental Performance:** The GHG and air-pollutant benefits of alternative marine fuels depend on the fuel-production pathway and should be assessed using credible lifecycle, well-to-wake methodologies.

- **Operational Considerations:** The storage, handling, and bunkering of these fuels require specialised infrastructure, safety protocols, and regulatory oversight due to their unique chemical and physical properties.

In June 2022, P4I partnered with Malaysia's Ministry of Transport (MOT) to conduct a feasibility study on establishing low-carbon bunkering hubs at PTP. The study also undertook a fuels assessment as part of the technical and commercial components above, resulting in a shortlist of alternative fuels on which to focus. These are outlined in Figure 1 below.

Figure 1: Shortlisted alternative fuels from P4I feasibility study

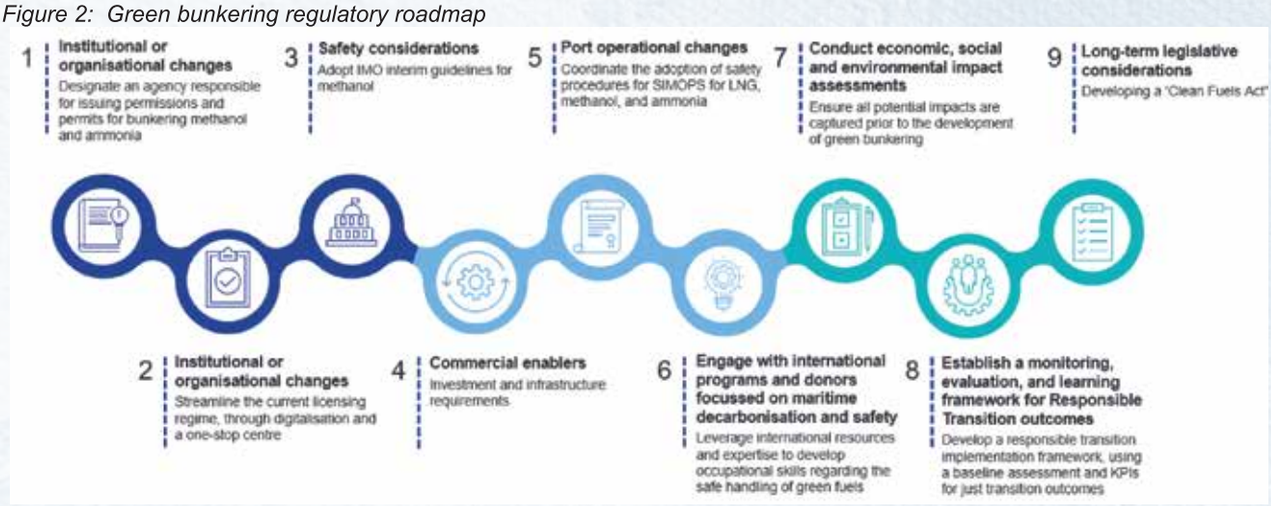


The primary objective of this Roadmap is to provide an implementation-oriented policy framework for Malaysia to progressively establish a safe, competitive and internationally aligned green bunkering ecosystem. It identifies regulatory gaps, priority actions, institutional and commercial enablers, and longer-term legislative considerations to support implementation.

Roadmap to Green Bunkering

The Roadmap comprises nine strategic actions developed from the regulatory analysis, stakeholder engagement and the earlier P4I–MOT feasibility work. The actions strengthen the regulatory foundations for green bunkering while addressing investment, infrastructure, safety, skills, responsible transition and long-term legislative coherence.

Figure 2: Green bunkering regulatory roadmap



The priority actions were informed by stakeholder validation undertaken by MOT and P4I in Kuala Lumpur on 3 October 2025. For implementation purposes, the Roadmap uses indicative time horizons: short term (2026–2027), medium term (2028–2029) and long term (2030 onwards). These horizons should be reviewed periodically as technologies, markets and international requirements evolve.

Table 1: Summary of roadmap recommendations

1. Institutional or organisational changes: designate an agency responsible for issuing permissions and permits for bunkering methanol and ammonia	**Priority**
Recommendations for action	● MOT will complete the formal designation of an existing authority with a clear mandate and operational framework for green-bunkering permissions and permits, including a published approval pathway. ● The designated arrangement will be reviewed after initial implementation and integrated into the permanent regulatory framework as required.
2. Institutional or organisational changes: streamline the current licensing regime, through digitalisation and a one-stop centre	**Priority**
Recommendations for action	● MOT will lead the digitalisation and coordination of regulatory procedures and establish a one-stop mechanism for green-bunkering approvals, licences and permits. ● Relevant approving authorities will maintain a consolidated process map and coordinated guidance to reduce duplication, improve transparency and shorten processing time without weakening statutory safeguards.

3. Safety considerations: operationalise relevant IMO interim safety and training guidance	Priority
Recommendations for action	● MMD will review and operationalise MSC.1/Circ.1621 (methyl/ethyl alcohol), MSC.1/Circ.1687 (ammonia) and MSC.1/Circ.1701 (hydrogen) through Malaysia Shipping Notices or other appropriate national instruments, prioritised according to Malaysia's implementation needs. ● MMD will consult port authorities, port operators, DOSH and industry to assess readiness and develop fuel-specific operating requirements. ● Training and competency arrangements will incorporate STCW.7/Circ.25 and the fuel-specific interim training guidance in STCW.7/Circ.26 and STCW.7/Circ.27, as applicable.

4. Commercial enablers: Investment and infrastructure requirements	Priority
Recommendations for action	● The Government will assess and, where appropriate, implement targeted fiscal and non-fiscal incentives for green-bunkering infrastructure, alternative-fuel production, research and development, subject to applicable financial processes. ● An accessibility assessment will be integrated into relevant port and bunkering infrastructure planning. ● MOT will facilitate a Green Bunkering Alliance or equivalent coordination platform to strengthen demand aggregation, investment and industry-government collaboration.

5. Port operational changes: coordinate the adoption of safety procedures for SIMOPS for LNG, methanol, and ammonia	Priority
Recommendations for action	**LNG SIMOPS** ● Use the LNG SIMOPS procedures developed through MMD, JPA, PTP, PETRONAS and other relevant stakeholders as the basis for nationally replicable guidance. ● MMD, in consultation with port authorities, DOSH and relevant stakeholders, will issue or coordinate the appropriate national guidance for LNG bunkering readiness and standard practice. ● Other port authorities will assess LNG bunkering readiness and implement the agreed national requirements. **Methanol SIMOPS** ● PTP, JPA, MMD and relevant stakeholders will validate methanol SIMOPS procedures and establish a model capable of replication at other Malaysian ports. ● MOT, MMD and DOSH will support implementation at other ports according to port-specific risk assessments **Ammonia SIMOPS** ● Pilot and validation exercises will be undertaken to test ammonia-bunkering readiness and develop SIMOPS procedures using IMO guidance and international good practice. ● All SIMOPS procedures will include comprehensive training and reskilling requirements for personnel, aligned with relevant IMO safety and training guidance and recognised curricula.

6. Engage with international programs and donors focussed on maritime decarbonisation and maritime safety to boost port readiness in using green fuels	Short term (2026–2027)
Recommendations for action	● Promote the uptake of international safety programs, frameworks and engagement with international organisations focused on safety and decarbonisation in the maritime industry, such as the Australia-Singapore Low-emissions Technologies Initiative, MJTTF, International Labour Organisation's Guidelines for a Just Transition, and the UN Global Compact. ● Establish requirements and standards aligned to international best practice for green fuel production and green bunkering operations.
7. Conduct economic, social, and environmental impact assessments	**Short term (2026–2027)**
Recommendations for action	● Establish a multi-disciplinary working group or committee to undertake the impact assessments, implementing a participatory consultation process and using sex, age, and disability disaggregated data to identify targeted mitigation and equitable benefit-sharing strategies. ● Establish a timeline for the completion of the assessments to ensure that they are conducted in a timely manner, emphasising transparent reporting mechanisms. ● Strengthen the climate-resilience of the Port infrastructure to protect investment in green bunkering and maximise nature-based solutions for coastal protection (storm surges and sea level rise), flooding, landslides, and heatwaves.
8. Establish a monitoring, evaluation, and learning framework for Responsible Transition outcomes	**Medium term (2028–2029)**
Recommendations for action	● Develop a set of Responsible Transition Key Performance Indicators (KPIs) ● Conduct periodic evaluation to support public reporting and learning, positioning Malaysia as a leader in sustainable and equitable maritime development.
9. Long-term legislative pathway: review the legal framework for clean and low-GHG fuels	**Long term (2030 onwards)**
Recommendations for action	● Establish an inter-agency legislative review task force led by the appropriate Government authority. ● Map legal gaps, overlaps and jurisdictional interfaces and consult Federal and State authorities, industry, workers and affected communities. ● Prepare and implement the preferred regulatory package, which may include amendments to existing laws, subsidiary instruments, coordinated sectoral measures and/or a dedicated Clean Fuels Act, subject to the applicable Government and legislative processes.

Stakeholder Mapping

The table below provides a brief overview of these key stakeholders and their areas of influence within the marine fuels supply chain.

Table 2: Malaysian Government and non-government green bunkering stakeholders

Stakeholder	Area of influence						
	Bunkering operations	Production	Planning & Construction	Transportation	Handling & Storage	Import	Pollution of sea, air & climate change
Government							
Ministry of Transport ● Malaysia Marine Department ● Land Public Transport Agency ● Domestic Shipping Licensing Board	✓		✓	✓	✓		✓
Ministry of Investment, Trade and Industry		✓					
Ministry of Natural Resources and Environmental Sustainability ● Department of Environment		✓	✓		✓		✓
Ministry of Domestic Trade and Cost of Living	✓	✓		✓	✓	✓	
Ministry of Human Resources ● Department of Occupational Safety and Health	✓	✓	✓	✓	✓		
Ministry of Finance ● Royal Malaysian Customs Department						✓	
Ministry of Plantation and Commodities	✓	✓		✓	✓		
National Disaster Management Agency	✓				✓		
Port Authorities	✓						
Non-government							
Industry ● Industry Associations ● Fuel & Energy Providers ● Shipowners & Shipping Lines ● Bunker Suppliers/Operators ● Ports & Terminal Operators ● Technology/Engineering & Service Providers ● Logistics/Port Users	✓	✓	✓	✓	✓	✓	✓

Regulatory Analysis

The regulatory analysis considered the four key fuel types outlined below:

- LNG;
- Methanol;
- Ammonia; and
- Hydrogen (due to its role in the production of methanol and ammonia)

The key focus areas for the regulatory framework assessment included:

- Bunkering operations (including safety procedures);
- Production;
- Planning and construction of facilities;
- Transportation;
- Import;
- Handling and storage; and
- Pollution of sea and air, and climate change

An overview of the key findings is presented below.

Key regulatory findings

- Malaysia has a strong regulatory framework under the Petroleum Development Act and other legislation for using LNG as a marine fuel. LNG bunkering in Malaysia is already happening at the Port of Tanjung Pelepas, where safety and SIMOPS procedures for the fuel have been adopted by the Johor Port Authority.
- Biofuels have an existing regulatory framework through the Malaysian Biofuel Industry Act of 2007.
- Green methanol and ammonia are new fuels in the maritime industry. While they sit under existing legislation regarding their use as industrial chemicals, they are not regulated as marine fuels. This has practical implications for safety and permitting and licensing.
- MMD will progressively operationalise the relevant IMO interim safety and training guidance for alternative marine fuels through Malaysia Shipping Notices and other appropriate national instruments, aligned with the maturity and intended use of each fuel in Malaysia.
- Port of Tanjung Pelepas has piloted methanol bunkering and has worked with industry stakeholders and relevant government authorities to advance the development of operating and SIMOPS procedures for consideration by the Johor Port Authority and other competent authorities.
- Adoption of SIMOPS procedures for LNG and methanol are key steps for establishing sustained bunkering operations in Malaysia.
- Addressing the complexity in the permitting and licensing process and clarifying which government agency is responsible for issuing licences for bunkering methanol and ammonia would make a significant difference for new industry entrants in Malaysia.
- Addressing the complexity in the permitting and licensing process and clarifying which government agency is responsible for issuing licences for bunkering methanol and ammonia would make a significant difference for new industry entrants in Malaysia.

- The Government and industry will assess investment and infrastructure requirements for green bunkering to address long-term supply constraints, safety needs and first-mover risks in the green marine fuels industry.
- As low- and zero-GHG marine fuels become more widely used, shipping lines will make critical fleet and fuel-supply decisions informed by net-zero commitments, regulation and commercial drivers. Malaysia will engage early and regularly with shipping lines and fuel suppliers to strengthen demand visibility and position Malaysian ports as credible hubs for alternative marine fuel supply and investment.
- Malaysia can build alliances and partnerships to address supply challenges, develop the industry, and improve safety. These alliances can be focussed on domestic industry but can also include international programmes and initiatives aimed at promoting use of green marine fuels.
- Implementation of the Roadmap will include further work on responsible-transition outcomes, including skills development and job creation, social protection, the green economy, accessibility, and community engagement and consultation, with these principles integrated into the relevant implementation workstreams.

Conclusion

As Malaysia seeks to strengthen its position in green bunkering, key regulatory gaps must be addressed, including the absence of standardised procedures for some alternative fuels, uncertainty over institutional responsibilities, and the complexity of the current licensing and approval process. The strategic actions in this Roadmap provide a coordinated pathway to address these gaps while strengthening safety, regulatory clarity, investment readiness and international alignment.



Photo Courtesy of PTP

1. Introduction to Green Bunkering

1.1. Background and rationale

For the purpose of this Roadmap, green bunkering refers to the safe supply and transfer of marine fuels and energy carriers that can deliver demonstrable reductions in GHG emissions on a lifecycle, well-to-wake basis, consistent with applicable national requirements and internationally recognised standards and methodologies. Relevant fuels and energy carriers may include low- and zero-GHG methanol, ammonia, sustainable biofuels, LNG and its renewable or synthetic derivatives, hydrogen and other emerging options, subject to their lifecycle emissions performance, safety requirements, technological maturity and commercial viability.

In recent years, the maritime sector has seen a global trend toward decarbonisation, driven by international regulations and commitments. This momentum is creating significant demand for low-carbon shipping fuels, which is expected to grow as regulation and market mechanisms evolve. Key drivers include:

- The Malaysian National Energy Transition Roadmap (NETR), which highlights the opportunity for Malaysia to position itself as a green bunkering hub as a result of the decarbonisation of the maritime sector and includes key initiatives to unlock opportunities in marine bunkering.
- The International Maritime Organization (IMO)'s ambition to achieve net-zero GHG emissions from international shipping by or around 2050, alongside efforts to establish an international carbon pricing scheme for shipping.
- IMO-approved draft regulations for mandatory marine fuel standards and GHG emission pricing.
- The inclusion of shipping in regional emissions trading schemes, such as the EU Emissions Trading System (ETS).
- Net-zero commitments by leading shipping companies, including Maersk, which has pledged to transition to green fuels.

Green bunkering is at the forefront of these developments, playing a critical role in enabling the maritime industry's transition toward sustainable operations.

1.1.1. Overarching Responsible Transition Principles

The Green Bunkering Regulatory Roadmap seeks to adopt a comprehensive approach to environmental sustainability by incorporating the principles of an equitable and inclusive transition to green bunkering, frequently referred to as a "responsible transition" in Malaysia's NETR and more widely known as a "just transition."[1] A responsible transition recognises that the shift to low-carbon fuels has different impacts to different stakeholders that are best identified through robust social impact analysis. The Maritime Just Transition Taskforce (MJTTF)'s 10-point action plan emphasises four main pillars of a responsible transition[2]:

- Green economy
- Decent work and skills development
- Social protection
- Community engagement and consultation.

The transition to green bunkering should be underpinned by a commitment to the highest safety standards across all green bunkering operations as well as attention to the necessary requirements to foster a diverse, skilled, and inclusive maritime workforce. These commitments and others identified in the roadmap align with the International Maritime Organisation's (IMO) revised GHG Strategy 2023, Malaysia's NETR, and other regional and national

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[1] For simplicity, this document will refer to principles of an equitable and inclusive transition to green bunkering as a "responsible transition", in alignment with language used in Malaysia's National Energy Transition Roadmap, though the approach is more universally known as a "just transition."

[2] Maritime Just Transition Task Force. (2022). Mapping a maritime just transition for seafarers: A 10-point action plan to upskill seafarers for a decarbonised shipping industry. International Chamber of Shipping, International Transport Workers' Federation, United Nations Global Compact, International Labour Organization, & International Maritime Organization. https://www.globalmaritimeforum.org/content/2022/11/Mapping-a-Maritime-Just-Transition.pdf

commitments. This roadmap seeks to highlight high-level actions for a responsible transition to green bunkering, aligned with the aforementioned four pillars, to prevent unintended negative impacts and ensure no one is left behind in this critical global transformation.

1.2. Definition and scope of Green Bunkering

Green bunkering encompasses the supply, storage, handling and transfer of marine fuels and energy carriers intended to reduce lifecycle GHG emissions compared with conventional fossil marine fuels. The policy treatment of each fuel should account for its production pathway, well-to-wake GHG intensity, safety characteristics, infrastructure needs, certification and traceability requirements, and commercial readiness. Accordingly, a fuel should not be characterised as "green" solely on the basis of its chemical type.

- **Lifecycle Environmental Performance**: The GHG and air-pollutant benefits of alternative marine fuels depend on the fuel-production pathway and should be assessed using credible lifecycle, well-to-wake methodologies.
- **Operational Considerations**: The storage, handling, and bunkering of these fuels require specialised infrastructure, safety protocols, and regulatory oversight due to their unique chemical and physical properties.

The deployment of green bunkering infrastructure and practices is a necessary step to align maritime operations with international decarbonisation efforts.

Green bunkering is a cornerstone for achieving international, regional, and national decarbonisation targets. The adoption of low-carbon fuels in the maritime sector yields:

- **Environmental Benefits:** Potential reductions in lifecycle GHG emissions, air pollutants and other environmental impacts where fuels and technologies meet credible sustainability and lifecycle-emissions criteria.
- **Economic Advantages:** Opportunities to attract investment in green infrastructure, stimulate job creation, and position countries as leaders in the emerging green economy.
- **Social Benefits:** Adopting principles of a responsible transition in green bunkering presents the opportunity to ensure equal distribution of benefits and mitigation of any potential negative social impacts, in turn strengthening economic benefits.
- **Global Climate Commitments:** Alignment with international frameworks such as the IMO's GHG Strategy and national energy transition roadmaps, ensuring the maritime industry contributes to broader climate goals.

By adopting green bunkering, the maritime sector can play a transformative role in reducing global emissions while enhancing energy security and economic resilience.

1.3. Malaysian maritime context

Malaysia is strategically positioned to lead the transition to green bunkering, given its location along the Malacca Strait, a vital maritime corridor through which approximately 30% of the world's traded goods pass annually. The country's two major container ports, Port Klang and the Port of Tanjung Pelepas (PTP), play critical roles in supporting the Asia-Europe trade lane. In 2024, Port Klang handled almost 15 million Twenty-Foot Equivalent (TEU),[3] while PTP handled more than 12 million TEU,[4] ranking both ports among the world's busiest.

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[3]Port Klang ranked 10th among world's busiest ports in 2024, says Loke. (2025, January 7). The Edge Malaysia. https://theedgemalaysia.com/node/740130

[4]Port of Tanjung Pelepas makes history as first container terminal in Malaysia to surpass 12 million TEUs throughput. (2025, January 2). MMC Ports. https://www.mmcports.com.my/port-of-tanjung-pelepas-makes-history-as-first-container-terminal-in-malaysia-to-surpass-12-million-teus-throughput/

PTP holds strategic significance due to its location near Singapore and its role as a hub for global shipping. The port's advanced infrastructure and connectivity make it a prime candidate for positioning Malaysia as a regional green bunkering hub. In addition, Malaysia's leadership in diversity and inclusion at PTP positions the port to adopt a progressive responsible transition approach to green bunkering.

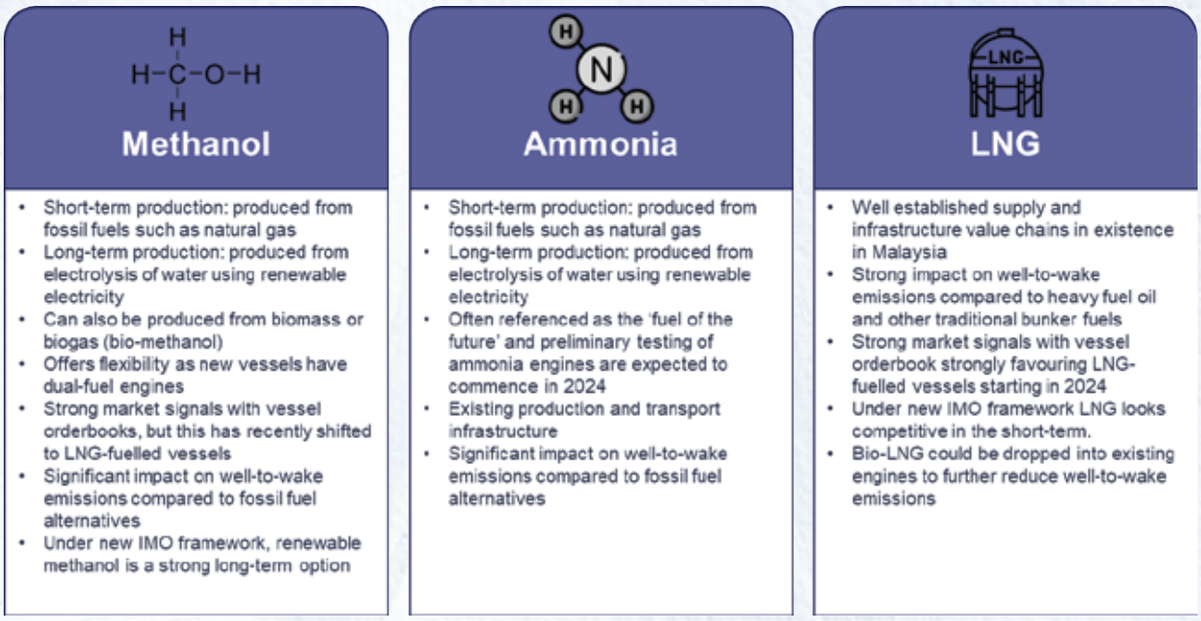
In June 2022, P4I partnered with Malaysia's Ministry of Transport (MOT) to conduct a feasibility study on establishing low-carbon bunkering hubs at PTP. This comprehensive study evaluated:

- **Technical Feasibility:** Infrastructure and operational requirements for green bunkering.
- **Commercial Viability:** Commercial benefits and market demand for low-carbon fuels.
- **Regulatory Assessment:** Opportunities and constraints in Malaysia's regulatory environment.
- **Socio-Economic Impact:** Potential contributions to Malaysia's green economy.

The study identified green methanol as the most promising low-carbon fuel alternative and confirmed PTP's strong potential to serve as a pilot green bunkering hub. However, one of the key findings from the study was the presence of potential regulatory gaps in Malaysia's framework for green bunkering. As a result, a more in-depth assessment of these gaps is required to ensure Malaysia can fully realise its potential in this evolving sector.

The study also undertook a fuels assessment as part of the technical and commercial components above, resulting in a shortlist of alternative fuels on which to focus. This was a collective assessment of demand, supply and emissions profiles of existing, and emerging and third horizon fuels across all stages of the decarbonisation pathway to 2050 to be assessed for bunkering.

Figure 3: Shortlisted alternative fuels from P4I feasibility study



1.4. Regulatory and operational overview

Malaysia's regulatory framework for the maritime and energy sectors is primarily designed to support traditional fossil fuel-based bunkering operations. Policies and regulations currently focus on upstream and downstream activities related to marine fuels, such as petroleum and LNG, with limited consideration for alternative low-carbon fuels like methanol and ammonia.

This focus on conventional fuels has created barriers to the development of green bunkering infrastructure. Existing legislation does not adequately address the unique requirements of green fuels, such as safety standards, operational protocols, and emissions regulations. Similarly, the current framework overlooks the critical social and workforce dimensions relevant to a responsible transition. Additionally, there are no targeted policies or incentives to encourage private sector investment in green bunkering, further limiting progress toward decarbonisation in maritime operations.

The global maritime industry is undergoing a transformative shift towards decarbonisation, driven by international and regional frameworks, technology development and changing commercial requirements. As an IMO Member State and a Category (c) Council member for the 2026–2027 biennium, Malaysia will continue to align its domestic regulatory development with internationally agreed measures while preserving sufficient flexibility to respond to evolving fuels, technologies and market conditions.

Countries and ports globally are already advancing their green fuel capabilities, with initiatives such as ammonia bunkering pilots in Rotterdam and methanol and hydrogen incentives in Singapore. Malaysia's strategic position along major shipping routes, particularly at the Port of Tanjung Pelepas, presents a unique opportunity to establish itself as a regional leader in green bunkering. However, this requires a regulatory framework that not only facilitates compliance with international standards but also supports the rapid adoption of alternative fuels. By creating a progressive and efficient regulatory ecosystem, Malaysia can attract investment, enhance its maritime infrastructure, and ensure its competitiveness in a rapidly evolving global shipping market.

Port of Tanjung Pelepas has already taken the initial steps through pilot operations for LNG and methanol bunkering. These pilots underscore Malaysia's potential to compete in the green bunkering space, but scaling these efforts will require a cohesive regulatory framework that supports the transition to low-carbon fuels.

1.5. Objectives and structure of the Roadmap

The primary objective of this Roadmap is to establish a practical policy pathway for scaling Malaysia's green bunkering capabilities. It sets out the regulatory, institutional, operational and enabling actions required to strengthen safety, investment certainty and competitiveness while maintaining alignment with national priorities and evolving international requirements.

The Roadmap first sets out Malaysia's current regulatory landscape, identifying the key areas that require updates to reflect the evolving global trend towards decarbonisation within the maritime sector. It highlights gaps in the existing framework and offers recommendations on where action is needed to enable green bunkering operations.

In addition to regulatory priorities, the Roadmap identifies the entities within Malaysia that may be best suited to take on specific responsibilities for advancing green bunkering initiatives. These responsibilities take into account the current structure of marine fuel governance and the roles of various government agencies, port authorities, and industry stakeholders.

Finally, the Roadmap identifies implementation and longer-term considerations for the Government of Malaysia. These considerations aim to ensure that the development of the green bunkering sector is comprehensively analysed and assessed. They include recommendations for future research, stakeholder engagement, and capacity-building efforts to enable long-term success.

Through this structured approach, the Roadmap seeks to:

1. Highlight regulatory gaps and propose updates to support green bunkering infrastructure.
2. Identify actionable steps and assign roles to relevant Malaysian entities to drive progress.
3. Present further considerations to ensure comprehensive analysis and informed decision-making.

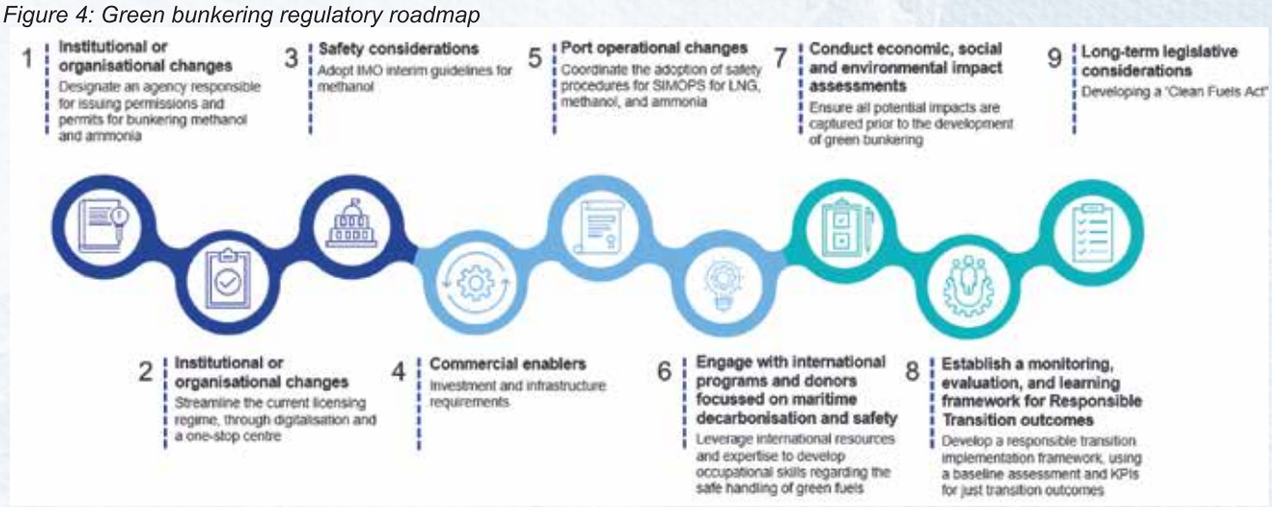
By focusing on practical steps and targeted actions, this Roadmap provides a clear pathway to help Malaysia unlock the economic, environmental, and strategic benefits of a thriving green bunkering sector.

2. Roadmap to Green Bunkering

This section builds on the regulatory analysis presented in Section 4 and P4I's previous work with MOT and PTP on a green bunkering feasibility study. It outlines a roadmap to establish a green bunkering industry in Malaysia, beginning with a focus on strengthening the country's regulatory frameworks. The chapter then identifies the foundational enablers necessary to support the development of the industry, including commercial enablers such as infrastructure and investment requirements, participation in international programmes, fostering collaboration between industry and government, and measuring the environmental, economic, and social impacts of the industry.

An overview of the regulatory roadmap is provided in Figure 4 below.

Figure 4: Green bunkering regulatory roadmap



The regulatory environment includes gaps in the use of methanol, ammonia and hydrogen as marine fuels. The actions in this Roadmap are organised into three implementation horizons: short term (2026-2027), medium term (2028-2029) and long term (2030 onwards). Table 3 summarises the principal regulatory gaps and links them to the nine strategic actions set out in the following subsections and further analysed in Section 4.

Table 3: Overview of key regulatory gaps and the relevant roadmap recommendations

Area for consideration	Key regulatory gaps	Relevant roadmap recommendations
Bunkering operations	• A lack of clarity regarding the regulation of green marine fuels. • A complex approvals process consisting of several agencies and departments.	1. Institutional changes: Designate an agency for bunkering permits 2. Institutional changes: Streamline the current licensing regime 3. Safety considerations: Adopt IMO interim guidelines 5. Operational changes: Adopt safety procedures for SIMOPS 9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels
Production	• Some regulatory gaps regarding the standardisation of safety measures for alternative fuels.	7. Economic, social and environmental impact assessments 9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels

Planning and construction	• A significant amount of approvals, licenses and permissions required from various authorities resulting in a complex and time consuming process. • Potential regulatory gaps in key safety legislation regarding the regulation of alternative fuels and the required infrastructure.	4. Commercial enablers: Investment and infrastructure requirements 7. Economic, social and environmental impact assessments 9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels
Transportation	• A regulatory gap regarding the regulation of alternative fuel transportation as current regulations only apply to petroleum.	4. Commercial enablers: Investment and infrastructure requirements 7. Economic, social and environmental impact assessments 9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels
Import	• Import requirements do not apply to non-petroleum products resulting in regulatory inconsistences. • Potential challenges surrounding the application of the Customs Act to alternative fuels.	9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels
Handling and storage	• Challenges surrounding co-ordination of several authorities for the enforcement of safety requirements. • No requirement for approval from the Department of Environment for the constructions of storage facilities for alternative fuels and no official design, construction or operation requirements for these facilities. • A lack of clarity regarding the regulation of workers on ships or on ports. • No enforceable standards for the storage and handling of alternative fuels on ships.	3. Safety considerations: Adopt IMO interim guidelines 4. Commercial enablers: Investment and infrastructure requirements 5. Operational changes: Adopt safety procedures for SIMOPS 6. Engage with international programmes and development partners
Pollution of sea and air, and climate change	• A lack of requirements for compulsory insurance for ships carrying alternative fuels. • Current regulatory frameworks for the emission of hazardous substances may not appropriately consider alternative fuels. • Currently no federal Bill addressing greenhouse gas emissions. • Nationally Determined Contributions do not include maritime decarbonisation	7. Economic, social and environmental impact assessments 9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels

2.1. Institutional changes: Designate an agency for bunkering permits

The Government will complete the institutional assessment and formal designation of the appropriate existing authority responsible for permissions and permits for methanol and ammonia as marine fuels, supported by a clear operational framework and published approval pathway.

Under the current licensing regime, no government agency is clearly tasked with overseeing these alternative fuels. While the Malaysian Biofuels Industry Act establishes a licensing process for biofuels through the Ministry of Plantation and Commodities, and the PDA under the purview of Prime Minister's Department, methanol and ammonia lack similar guidance, highlighting a key regulatory gap in Malaysia's green marine fuel pathway. For its methanol bunkering pilot activity, PTP sought approvals through MMD and JPA. While this approach was sufficient for a pilot, it does not provide the clarity or structure required for sustained bunkering operations. A designated agency will ensure clear oversight and support the safe, efficient implementation of green bunkering activities.

Formal designation of the responsible authority will reduce regulatory uncertainty, improve accountability and provide industry with a clear entry point for green-bunkering applications. It will also support safer and more predictable investment by ensuring that institutional responsibilities are transparent and coordinated across the relevant approvals.

Table 4: Objectives, rationale and recommendations for action for designating an agency for bunkering permits

Priority	
Objective	Designate an existing agency to be tasked with issuing permissions and permits for bunkering licenses, focused on the safe and efficient implementation of methanol and ammonia bunkering procedures.
Rationale	A designated authority will close the institutional gap for alternative fuels, strengthen oversight and provide a clear regulatory entry point for industry.
Recommendations for action	• MOT will complete formal designation of the responsible authority, with a clear mandate, operational framework and published approval pathway. • The institutional arrangement will be reviewed after initial implementation and integrated into the permanent framework as required.

2.2. Institutional changes: Streamline the current licensing regime

The Government of Malaysia will pursue the progressive streamlining of the licensing regime for bunkering to strengthen the country's competitiveness as a preferred destination for bunkering operations.

As discussed in Section 4.2.3 of this Roadmap, industry players currently face a lengthy and bureaucratic process requiring engagement with multiple government agencies to acquire necessary approvals, licences, and permits for traditional bunkering activities. This fragmented process increases costs and delays, creating a barrier for both traditional and alternative marine fuels.

To strengthen Malaysia's competitiveness in green bunkering, the Roadmap prioritises simplifying and accelerating the approval process for alternative fuels such as methanol and ammonia. Streamlining these procedures can reduce unnecessary administrative burden, improve regulatory transparency and support the use of lower-GHG fuels at Malaysian ports, subject to applicable safety and environmental requirements.

Singapore, for example, has established a One-Stop-Centre that aims to make the process of acquiring bunkering approvals, licences and permits simpler. This Centre is operated by a single government agency, the Maritime and Port Authority of Singapore.

Table 5: Objectives, rationale and recommendations for action for streamlining the current licensing regime

Priority	
Objective	Strengthen Malaysia's competitiveness in bunkering through streamlining the licensing regime.
Rationale	Streamlining the licensing regime brings Malaysia in line with licensing processes followed at other major bunkering ports globally and can create an incentive for the use of methanol and ammonia as a marine fuel.
Recommendations for action	● MOT will lead digitalisation and coordination of regulatory procedures and establish a one-stop mechanism for bunkering approvals, licences and permits. ● Relevant authorities will maintain a consolidated process map and coordinated guidance to reduce duplication, improve transparency and support predictable processing.

2.3. Safety considerations: Operationalise relevant IMO interim safety and training guidance

Malaysia implements the International Convention for the Safety of Life at Sea (SOLAS) and relevant IMO requirements through the Merchant Shipping Ordinances and national instruments, including Malaysia Shipping Notices (MSNs). The IGF Code provides the mandatory safety framework for ships using gases or other low-flashpoint fuels, while IMO has progressively developed fuel-specific interim guidance for emerging fuels not yet comprehensively covered by prescriptive provisions.

As at September 2026, IMO has issued interim safety guidelines for ships using methyl/ethyl alcohol as fuel (MSC.1/Circ.1621), ammonia as fuel (MSC.1/Circ.1687) and hydrogen as fuel (MSC.1/Circ.1701). IMO has also issued generic interim training guidelines for seafarers on ships using alternative fuels and new technologies (STCW.7/Circ.25), together with fuel-specific training guidelines for methyl/ethyl alcohol (STCW.7/Circ.26) and ammonia (STCW.7/Circ.27).

MMD will review and progressively operationalise the relevant IMO safety and training guidance through MSNs, competency arrangements and other appropriate national instruments, prioritised according to Malaysia's fuel deployment plans, port readiness and operational risk. Implementation will be undertaken in consultation with port authorities, port operators, the Department of Occupational Safety and Health (DOSH), training institutions and industry.

Table 6: Objectives, rationale and actions for operationalising IMO interim safety and training guidance

Priority	
Objective	Align Malaysia's regulatory standards and competency arrangements with current IMO safety and training guidance for alternative marine fuels.
Rationale	Alignment with current IMO guidance strengthens safety, international interoperability and regulatory certainty for alternative marine fuels. ● Fuel-specific implementation supports port readiness, workforce competency and the safe deployment of methanol, ammonia and hydrogen as their use matures in Malaysia. ● Compliance with the IMO's resolution inviting Member States to bring the Interim Guidelines to the attention of Malaysia's ports, shipping, and other relevant industries.
Recommendations for action	● MMD will review and operationalise MSC.1/Circ.1621, MSC.1/Circ.1687 and MSC.1/Circ.1701 through MSNs or other appropriate national instruments, prioritised according to implementation needs. ● MMD will consult port authorities, port operators, DOSH and industry to assess readiness and develop fuel-specific operating requirements. ● Training and competency arrangements will incorporate STCW.7/Circ.25, STCW.7/Circ.26 and STCW.7/Circ.27, as applicable.

2.4. Commercial enablers: Investment and infrastructure requirements

2.4.1. Infrastructure needs for bunkering operations

The successful implementation of green bunkering operations requires specialised infrastructure tailored to the technical specifications of alternative fuels. This includes:

- **Storage facilities:** Tanks designed specifically for LNG, methanol, and ammonia to ensure safe containment and compliance with international safety standards. The construction and operation of the storage facilities should align with global occupational health and safety standards.
- **Fuel transfer systems:** Jetties and pipelines to support the efficient transfer of fuel to bunker barges, equipped with systems designed for the unique properties of each fuel.
- **Bunker barges:** Adequate numbers of specialised barges are required to transport alternative fuels safely and efficiently to ships at berth or anchorage. Investment planning will include sufficient training programmes aligned with recognised international standards and curricula.

Although the physical footprint of such infrastructure is relatively small, the associated investments are substantial. For instance, LNG bunker barges require significant capital to meet the technical and safety specifications for transporting LNG. Similarly, methanol and ammonia infrastructure will need to meet strict safety and operational standards.

Infrastructure development also provides an opportunity to improve accessibility across ports and new bunkering facilities. Accessibility assessments should be incorporated into project planning so that universal design principles can enhance safety and broaden workforce participation.

Investing in this infrastructure is not just a logistical necessity but also a strategic imperative. Without it, Malaysia risks losing its competitive position as a regional maritime hub. The availability of advanced bunkering infrastructure will attract international shipping companies seeking compliant and efficient refuelling options, thereby increasing port traffic and revenue.

2.4.2.Investment drivers

Investment in green bunkering operations and infrastructure in Malaysia will be driven by several factors. These factors will inform stakeholders and their decision-making regarding Malaysia as a green bunkering hub and therefore, it is crucial that these are considered and supported where possible.

These factors include:

- **A clear and robust regulatory framework:** a regulatory framework that is clear and robust will provide transparent requirements and guidance for organisations investing in green bunkering in Malaysia.
- **A supportive government environment:** a government environment that supports investment, for example in the form of tax incentives or subsidies, may support further investment in green bunkering.
- **Steady revenue and known costs:** the potential for steady and predictable revenue and understanding known costs will also impact businesses and their decision to invest in green bunkering in Malaysia and an environment in which steady revenue is expected will promote investment.
- **Infrastructure availability:** the current level of availability of the required infrastructure may impact some organisations decision to invest in the green bunkering industry in Malaysia.
- **The available labour market:** the availability of skilled labour that can meet the needs of the green bunkering industry, particularly in the areas of efficiency and safety will also be a key driver of investment.
- **Demonstrated investment from shipping lines:** demonstrated investment from shipping lines in Malaysia and in the broader region provides an indication of global demand for green bunkering services and is therefore a key driver of investment.

Government action on regulatory clarity, enabling infrastructure, skills and targeted incentives will help crowd in private-sector investment. Public intervention will be calibrated to credible market demand, while private investment will remain central to the commercial success and regional competitiveness of Malaysia's green-bunkering ecosystem.

2.4.3. Government incentives for investment

The Government will assess and, where appropriate, implement a targeted incentive framework to attract investment in green-bunkering operations and alternative-fuel production. Potential measures include tax reliefs, grants and subsidies, subject to applicable fiscal processes, together with support for research and development (R&D), innovation, safety and workforce capability. Measures will be designed to manage first-mover risks while supporting high-quality employment and responsible-transition outcomes.

By offering strategic incentives, Malaysia can position itself as a leader in the green marine fuel industry. These incentives will attract local and international investors, enabling the country to build a robust ecosystem for green bunkering. Moreover, fostering innovation through R&D will ensure Malaysian ports maintain a competitive edge in the global transition to low-carbon shipping. In doing so, Malaysia can secure long-term economic benefits, create job opportunities, and cement its status as a regional bunkering hub that champions sustainable and inclusive job creation across the value chain.

2.4.4. Catalysts for investment

As green marine fuels become more widely used in the maritime industry, shipping lines will also begin to make critical new green fleet acquisition decisions, informed by their own net-zero commitments and commercial drivers. A key consideration for the shipping lines will be the future supply of alternative fuels, including which ports are able to refuel their vessels. Other factors may include the impact of new IMO regulations, geopolitical impacts, shipping routes, the current state of technology and cost profiles. For example, the Gemini Cooperation between shipping companies Hapag-Lloyd and Maersk aims at boosting connectivity, sustainability, and the reliability of its network. In some cases, shipping lines may enter into direct long-term fuel supply contracts with ports to secure this supply. Malaysia should engage early and often with shipping lines to ensure that Malaysia can be seen as a potential hub for alternative green fuel supply to attract both shipping lines and other investors.

2.4.5. Investment enablers

To drive significant investment, Malaysia will assess the establishment of a Green Bunkering Alliance - a coalition of stakeholders across the maritime value chain, including port operators, fuel producers, shipping companies, and government agencies. This alliance would provide a platform to coordinate efforts, share knowledge, and present a unified case for investment in green bunkering infrastructure.

A relevant example is the Port of Melbourne's Memorandum of Understanding with key industry players, which explores the feasibility of a green methanol bunkering hub. The MoU involves fuel producers, terminal operators, and shipping companies collaborating to address challenges and attract investment.[5] Malaysia could adopt a similar model, leveraging partnerships with international stakeholders to accelerate the development of its green bunkering capabilities. Such alliances can also identify challenges, implement solutions, and create confidence among investors.

Table 7: Objectives, rationale and recommendations for action for investment and infrastructure requirements

Priority	
Objective	Accelerate investment in bunkering infrastructure
Rationale	● Ensures that Malaysia has the appropriate infrastructure in place to support green bunkering operations and ensures stable and sustainable supply of green fuels for the maritime industry. ● Integrates the opportunity to embed universal design in updated bunkering infrastructure and port re-design, promoting accessibility and inclusivity in the workplace. ● Positions Malaysia as a leading hub for bunkering services in the region, , attracting greater employment opportunities for diverse, skilled talent in the maritime sector.
Recommendations for action	● The Government will assess and, where appropriate, implement targeted fiscal and non-fiscal incentives to support green-bunkering infrastructure, alternative-fuel production and innovation, subject to applicable financial processes. ● Conduct an accessibility assessment and integrate universal design into relevant port and bunkering infrastructure planning. ● Establish a Green Bunkering Alliance or equivalent coordination platform to strengthen investment, demand aggregation and industry-government collaboration.

[5] *Port of Melbourne, 2025, Green methanol MoU signed with Melbourne port*

2.5. Operational changes: Adopt safety procedures for SIMOPS

A key first step in Malaysia's regulatory roadmap for green bunkering involves the adoption of bunkering procedures for Simultaneous Operations (SIMOPS), which refer to the practice of conducting bunkering activities alongside other port operations, such as cargo loading and unloading, at the same time. These procedures are crucial for enhancing the efficiency and safety of bunkering operations, particularly for alternative fuels like LNG and methanol. Additionally, to the extent possible, implementation of all SIMOPS procedures should be underpinned by a commitment to principles of a responsible transition, ensuring comprehensive training and reskilling modules, covering safety requirements of alternative fuels and employing established global standards and curricula to ensure high quality skills training.

Malaysia is well-positioned to move quickly on SIMOPS procedures for LNG. LNG is already well-regulated under the existing framework, with no significant regulatory barriers to implementation. PTP has extensive experience in safely conducting LNG bunkering under SIMOPS conditions, demonstrating that such operations can be effectively managed within Malaysian ports. PETRONAS has an LNG bunker vessel on lease. This positions PTP as a leader in LNG bunkering practices, offering a model that other Malaysian ports can emulate.

Building on this expertise, the Johor Port Authority has worked closely with PTP to develop and adopt SIMOPS procedures for LNG bunkering which was developed by MMD and PETRONAS in collaboration with the Port Authorities and other relevant stakeholders, securing approval from MMD under MOT. This collaboration showcases Malaysia’s capability to manage complex bunkering operations while maintaining high safety standards, setting the stage for future advancements in green fuel bunkering under SIMOPS conditions.

The next step is to formalise and progressively adopt SIMOPS procedures for methanol bunkering. This process should be transparent, risk-based and participatory, ensuring that the transition does no unintended harm and that safety and equity considerations are addressed. PTP and JPA are well positioned to contribute operational experience following PTP’s first methanol bunkering pilot in November 2024 for the dual-fuel container vessel Antonia Maersk. Relevant stakeholders, including MMD, Department of Occupational Safety and Health, port authorities, port operators and industry, should use the lessons from pilot activities and technical workshops to develop procedures suitable for national replication.

The Government will establish or designate a technical task force to coordinate the review of international standards and domestic requirements for the safe transportation, handling and bunkering of methanol and ammonia. The task force will identify regulatory gaps, recommend national instruments and ensure that responsible-transition principles are integrated into implementation.

Malaysia will draw on current international guidance and industry standards, including IAPH bunkering checklists and relevant port practices. IMO’s fuel-specific interim safety guidelines now include MSC.1/Circ.1621 for methyl/ethyl alcohol, MSC.1/Circ.1687 for ammonia and MSC.1/Circ.1701 for hydrogen, providing a current international reference point for national safety and operational requirements.

Table 8: These international instruments will be used alongside Malaysian operational experience to develop proportionate, risk-based procedures for ship-to-ship, truck-to-ship and other bunkering configurations, including SIMOPS where appropriate.

Priority	
Objective	Enable the regulation of LNG and methanol bunkering during SIMOPS scenarios by port authorities.
Rationale	SIMOPS allows multiple activities to occur at the same time as refuelling and ports will be supported to turn over vessels rapidly.
Recommendations for action	**LNG SIMOPS** ● Use SIMOPS procedures for LNG bunkering developed by the MMD, JPA, PTP, PETRONAS, and other stakeholders as a national standard. ● Issuance of a Malaysia Shipping Notice by MOT, in consultation with MMD, relevant port authorities and port commissions, the Department of Occupational Safety and Health, and other relevant stakeholders to outline steps for port authorities to assess for LNG bunkering readiness and advise on LNG bunkering standard practices. ● Other port authorities work with MOT to assess LNG bunkering readiness. **Methanol SIMOPS** ● Organised by PTP, key stakeholders participate in a workshop on SIMOPS procedures, and JPA adopts these procedures as a national standard. ● MOT and Department of Occupational Safety and Health provide consultation on implementation at other ports. **Ammonia SIMOPS** ● Conduct pilot exercises to test readiness. Use findings and international best practices to develop SIMOPS procedures for ammonia bunkering. Ensure that all SIMOPS procedure development includes comprehensive training for all personnel involved, covering all safety requirements of alternative fuels, using regional and global standards and curricula.

2.6. Engage with international programmes and donors

Malaysia will continue to engage with international programmes and development partners focussed on maritime decarbonisation and maritime safety to enhance occupational skills regarding the use and handling of alternative marine fuels.

There are several international organisations and programmes that are focused on green fuels and maritime safety that would be beneficial for the Malaysian government to engage with. These organisations and programmes are a valuable resource for improving the safety of individuals who are involved in the use of alternative marine fuels such as methanol, ammonia and hydrogen through training and education. Collaboration with these entities will help to align Malaysia's standards with internationally recognised best practices, safety standards, and training methodologies, ensuring greater alignment with responsible transition principles. Among these safety organisations and programmes is the Global Ports Safety (GPS) Project, International Association of Ports and Harbors and the Australia-Singapore Low-Emissions Technologies (ASLET) Initiative for Maritime and Port Operations.

Global Ports Safety Project

GPS offers a comprehensive training program which is focused on improving the safety of ports and resilience in South and South-East Asia. The training program offers four learning modules covering the areas of hazardous material management and emergency response, in addition to several other useful resources.[6]

International Association of Ports and Harbors

The IAPH is an international organisation which works to promote the interests of ports across the world. It aims to do this through the following objectives:

- Strengthening relationships between member ports;
- Leveraging member expertise through technical committees and programmes that focus on port and maritime industry concerns;
- Promoting and demonstrating a commitment to a more environmentally sustainable maritime industry; and
- Proactively coordinating with other organisations in the maritime industry and advocating for global solutions to the issues that IAPH members face.
- IAPH has been at the forefront of developing safety checklists for bunkering with LNG and methanol.

The IAPH is recognised by several United Nations specialised agencies and one intergovernmental body as the only international organisation representing the world port industry.[7]

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

The ASLET Initiative aimed to design, develop and pilot a comprehensive safety and training program for maritime and port operations personnel with a focus on safe handling and use of ammonia as a marine fuel. Key stakeholders involved in the development of this program are the Australian Maritime Safety Authority (AMSA), the Australian Maritime College, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Maritime and Port Authority of Singapore (MPA).

Additional organisations and international programmes which can support Malaysia's efforts to establish green bunkering are set out in Appendix A: Other Maritime Decarbonisation Initiatives.

[6] *Global Ports Safety, 2025, GPS Training Platform*
[7] *International Association of Ports and Harbors, 2025, Vision & Mission*

Table 9: Objectives, rationale and recommendations for action for engaging with international programmes and donors

Short term (2026–2027)	
Objective	Leverage international resources and expertise to bolster Malaysia's maritime safety standards, ensuring training and occupational skills surrounding the handling of alternative marine fuels align with global standards
Rationale	● Ensures alignment to existing international best practice for the handling and use of alternative fuels such as methanol, ammonia and hydrogen. ● Enhances workforce skills in the bunkering industry in Malaysia. ● Demonstrates commitment to a responsible transition approach, in line with the IMO's GHG Strategy 2023 and the Maritime Just Transition Taskforce (MJTTF), which can in turn attract investments and partnerships.
Recommendations for action	● Promote the uptake of international safety programmes, frameworks and engagement with international organisations focused on safety and decarbonisation in the maritime industry, such as the Australia-Singapore Low-emissions Technologies Initiative, MJTTF, International Labour Organisation's Guidelines for a Just Transition, and the UN Global Compact. ● Establish requirements and standards aligned to international best practice for green fuel production and green bunkering operations.

2.7. Economic, social, and environmental impact assessments

Malaysia will progressively undertake economic, social and environmental impact assessments to understand the potential outcomes and implications of introducing green bunkering with alternative fuels. These assessments will allow the government to identify possible risks and develop strategies to avoid or mitigate them.

These impact assessments will support a sustainable and responsible transition by identifying risks, affected groups and mitigation measures. Assessments will, where relevant, draw on international good practice, transparent consultation and disaggregated data. Findings will inform future regulatory instruments, investment decisions, community-engagement arrangements and resilience measures under this Roadmap.

Disaster Risk Reduction and Climate Change (DRRCC)

The establishment of green-fuel bunkering hubs at the Port of Tanjung Pelepas (PTP) and other Malaysian ports should incorporate disaster-risk reduction and climate-resilience considerations from the design stage. Relevant measures may include resilient quay and storage infrastructure, real-time hazard monitoring, emergency shutdown systems, coastal protection, flood and heat-risk management, and nature-based solutions where appropriate. The IMO's 2023 GHG Strategy and the evolving Net-Zero Framework are expected to strengthen commercial incentives for lower-lifecycle-GHG fuels; however, the final international pricing and compliance arrangements remain subject to the IMO adoption process. Integrating climate resilience, safety and lifecycle-emissions integrity into green-bunkering investment will help protect communities, infrastructure and supply-chain continuity while supporting Malaysia's competitiveness.

Table 10: Objectives, rationale and recommendations for action for an economic, social, and environmental impact assessments

Short term (2026–2027)	
Objective	Ensure all potential impacts of green bunkering, particularly the differentiated impacts to women, people with disabilities, indigenous and ethnic minorities, and communities whose livelihoods/homes are located near the green bunkering site, are assessed and ensure these impacts are addressed appropriately.
Rationale	**Impact assessments:** ● Identify potential economic, social and environmental impacts of green bunkering and support the ongoing monitoring of these impacts. ● Ensure green bunkering operations with alternative fuels aligns with Malaysia's broader economic, social and environment goals.
Recommendations for action	● Establish a multi-disciplinary working group or committee to undertake the impact assessments, implementing a participatory consultation process and using sex, age, and disability disaggregated data to identify targeted mitigation and equitable benefit-sharing strategies. ● Establish a timeline for the completion of the assessments to ensure that they are conducted in a timely manner, emphasising transparent reporting mechanisms. ● Strengthen the climate-resilience of port infrastructure to protect investment in green bunkering and maximise nature-based solutions for coastal protection (storm surges and sea level rise), flooding, landslides, and heatwaves.

2.8. Establish a monitoring, evaluation, and learning framework for responsible transition outcomes

As green bunkering and maritime decarbonisation initiatives rapidly evolve, more and more governments are adopting elements of a responsible transition to ensure the shift prioritises social equity and workforce resilience. Adopting a clear and results-based monitoring, evaluation, and learning (MEL) framework for responsible transition outcomes can support Malaysia's maritime sector to ensure accountability and facilitate stronger alignment with Malaysia's NETR and global standards and best practices. The development of Key Performance Indicators (KPIs) allows for consistent tracking of progress, demonstrating a credible commitment to inclusive and sustainable development. Governments which adopt transparent reporting on efforts and progress are shown to attract greater investor confidence and stakeholder trust.

Through the development of a responsible transition implementation framework, Malaysia can better position itself as a regional leader in inclusive and sustainable maritime decarbonisation.

Table 11: Objectives, rationale and recommendations for action for establishing a monitoring, evaluation, and learning framework for Responsible Transition outcomes

Medium term (2028–2029)	
Objective	Develop a responsible transition implementation framework, using a baseline assessment and KPIs for just transition outcomes, to support equitable and inclusive implementation and progress, in line with Malaysia's NETR and other national commitments to diversity and inclusion in maritime.
Rationale	● Ensures stronger evidence-based and adaptive policymaking ● Leads to stronger public reporting and greater economic benefits
Recommendations for action	● Develop a set of Responsible Transition Key Performance Indicators (KPIs) ● Conduct periodic evaluation to support public reporting and learning, positioning Malaysia as a leader in sustainable and equitable maritime development.

2.9. Long-term legislative pathway: Review the legal framework for clean and low-GHG fuels

The regulatory analysis identifies a longer-term need to review Malaysia's legislative architecture for clean and low-GHG fuels. The Government will undertake a comprehensive, cross-sectoral legislative review to determine the most appropriate long-term regulatory approach. Options will include amendments to existing legislation, subsidiary regulations, coordinated sector-specific instruments and, if warranted, a dedicated Clean Fuels Act. The review will be led through the applicable Government and legislative processes in consultation with relevant Federal and State authorities, industry, workers and affected communities.

Malaysia's existing laws regulate different parts of the fuel and maritime value chain, but there is no single standardised legal framework dedicated to low- and zero-GHG fuels such as green methanol and green ammonia. This can create regulatory uncertainty where fuel origin, safety requirements, licensing, transport, storage, environmental controls and maritime operations fall under different statutes or authorities. The legislative review will examine how greater consistency, clarity and interoperability can be achieved across the Malaysian maritime value chain.

Malaysia implements a range of international maritime conventions and domestic laws. The legislative review will determine whether existing instruments sufficiently address the specific risks and opportunities associated with emerging low- and zero-GHG fuels, and whether targeted amendments, subsidiary instruments or a new overarching framework are warranted. The review will ensure alignment with safety, climate, energy and environmental laws and internationally agreed standards and methodologies.

A potential model for such a comprehensive legislation is the Malaysian Biofuel Industry Act 2007. The Act was introduced to regulate the sector and support development of the biofuels industry with a clear legislative framework. It achieves the following for biofuels in Malaysia:

- Defines what constitutes a biofuel in Malaysia
- Establishes a regulatory framework for blending, storage, transport, and export of biofuels
- Streamline licensing procedures for producers. Activities licensed include:
  - construction of any biofuel or blending plant,
  - production of any biofuel, and
  - blending of any biofuel with any other fuel or biofuel.
- Establishes a government authority to issue licences (e.g. Ministry of Plantation and Commodities)
- Sets up an enforcement mechanism and powers to sample and test fuels for compliance with the Act.

The Malaysian Biofuel Industry Act 2007 demonstrates how a dedicated framework can provide clear definitions, licensing, institutional responsibility and enforcement for an emerging fuel industry. The legislative review will assess whether similar functions for methanol, ammonia and other low- and zero-GHG fuels are best delivered through amendments to existing laws, coordinated subsidiary instruments or a dedicated overarching statute.

The emergence of new fuels across transport and industry creates a risk of fragmented requirements across jurisdictions and legal domains. Because maritime fuel supply chains are inherently cross-sectoral and may involve Federal, State and local authorities, Malaysia will pursue a coordinated regulatory architecture that minimises duplication, protects workers and communities, and provides consistent expectations to investors and operators.

The legislative review will assess legal gaps, overlaps and institutional responsibilities and recommend the most proportionate combination of legislative and non-legislative measures for Malaysia, taking account of Federal-State jurisdictional arrangements and the need for future policy adaptability.

Table 12: Objectives, rationale and actions for the long-term legislative review of clean and low-GHG fuels

Long term (2030 onwards)	
Objective	Undertake a comprehensive cross-sectoral legislative review to determine the most appropriate long-term regulatory architecture for clean and low-GHG fuels in maritime transport and related supply chains.
Rationale	A legislative review will identify gaps, overlaps and inconsistencies; clarify definitions, certification and lifecycle-emissions integrity requirements; assess licensing, enforcement and institutional options; support investment certainty; and provide a basis for safety, workforce, community and responsible-transition outcomes. The review will consider a dedicated Clean Fuels Act among the available options without prejudging the final legislative form.
Recommendations for action	● Establish an inter-agency legislative review task force led by the appropriate Government authority. ● Map legal gaps, overlaps and jurisdictional interfaces across the clean-fuel supply chain. ● Consult Federal and State authorities, industry, workers and affected communities. ● Prepare and implement the preferred regulatory package, which may include amendments to existing laws, subsidiary regulations, coordinated sectoral instruments and/or a dedicated Clean Fuels Act, subject to the applicable Government and legislative processes. ● Establish an implementation and periodic-review mechanism for the selected approach.

3. Stakeholder Mapping

Across the marine fuels supply chain, several key government and non-government stakeholders play a critical role in shaping the regulatory environment for green bunkering and the domestic production of green fuels in Malaysia. Many of these stakeholders are already deeply involved in the regulation of petroleum-based marine fuels and LNG.

This section offers a brief overview of these key stakeholders and their areas of influence within the marine fuels supply chain. Table 13 outlines the entities responsible for various focus areas relevant to the development of green bunkering in Malaysia.

Table 13: Malaysian Government and non-government green bunkering stakeholders

Stakeholder	Area of influence						
	Bunkering operations	Production	Planning & Construction	Transportation	Handling & Storage	Import	Pollution of sea, air & climate change
Government							
Ministry of Transport ● Malaysia Marine Department ● Land Public Transport Agency ● Domestic Shipping Licensing Board	✓		✓	✓	✓		✓
Ministry of Investment, Trade and Industry		✓					
Ministry of Natural Resources and Environmental Sustainability ● Department of Environment		✓	✓		✓		✓
Ministry of Domestic Trade and Cost of Living	✓	✓		✓	✓	✓	
Ministry of Human Resources ● Department of Occupational Safety and Health	✓	✓	✓	✓	✓		
Ministry of Finance ● Royal Malaysian Customs Department						✓	
Ministry of Plantation and Commodities	✓	✓		✓	✓		
National Disaster Management Agency	✓				✓		
Port Authorities	✓						
Non-government							
Industry ● Industry Associations ● Fuel & Energy Providers ● Shipowners & Shipping Lines ● Bunker Suppliers/Operators ● Ports & Terminal Operators ● Technology/Engineering & Service Providers ● Logistics/Port Users	✓	✓	✓	✓	✓	✓	✓

The stakeholder mapping exercise highlights the broad range of government and non-government entities involved in the regulation, development, and implementation of green bunkering and domestic green fuel production in Malaysia. Key government stakeholders include the Ministry of Transport, Ministry of Investment, Trade and Industry, Ministry of Natural Resources and Environmental Sustainability, Ministry of Domestic Trade and Cost of Living, and Ministry of Human Resources, among others. These ministries and their respective agencies influence critical stages of the green bunkering lifecycle, such as bunkering operations, production, planning and construction, transportation, handling and storage, and pollution control. Non-government entities, such as port authorities and industry players, play a complementary role in operationalising and supporting these regulatory frameworks.

The mapping reveals overlaps in responsibilities across different areas, particularly in handling and storage, pollution control, and planning and construction, which involve multiple government agencies. While this collaboration is vital for comprehensive regulation, it also underscores the need for clear coordination mechanisms to avoid redundancies and streamline the regulatory process. Additionally, the Johor Port Authority stands out as a key stakeholder, with significant responsibilities in licensing bunkering operations and handling and storage, reflecting its central role in facilitating green fuel adoption within Malaysian waters.

The stakeholder ecosystem for green bunkering is diverse and involves numerous entities with specific areas of influence. The detailed responsibilities of each stakeholder, as outlined in the appendices, provide a clear framework for managing the transition to sustainable marine fuels. However, ensuring effective inter-agency coordination and addressing potential regulatory gaps will be crucial for enabling Malaysia to achieve its green bunkering objectives efficiently.

A detailed overview of the responsibilities of each of the stakeholders in Table 13 can be found in Appendix B: Key Stakeholders.

4. Regulatory Analysis

4.1. Scope

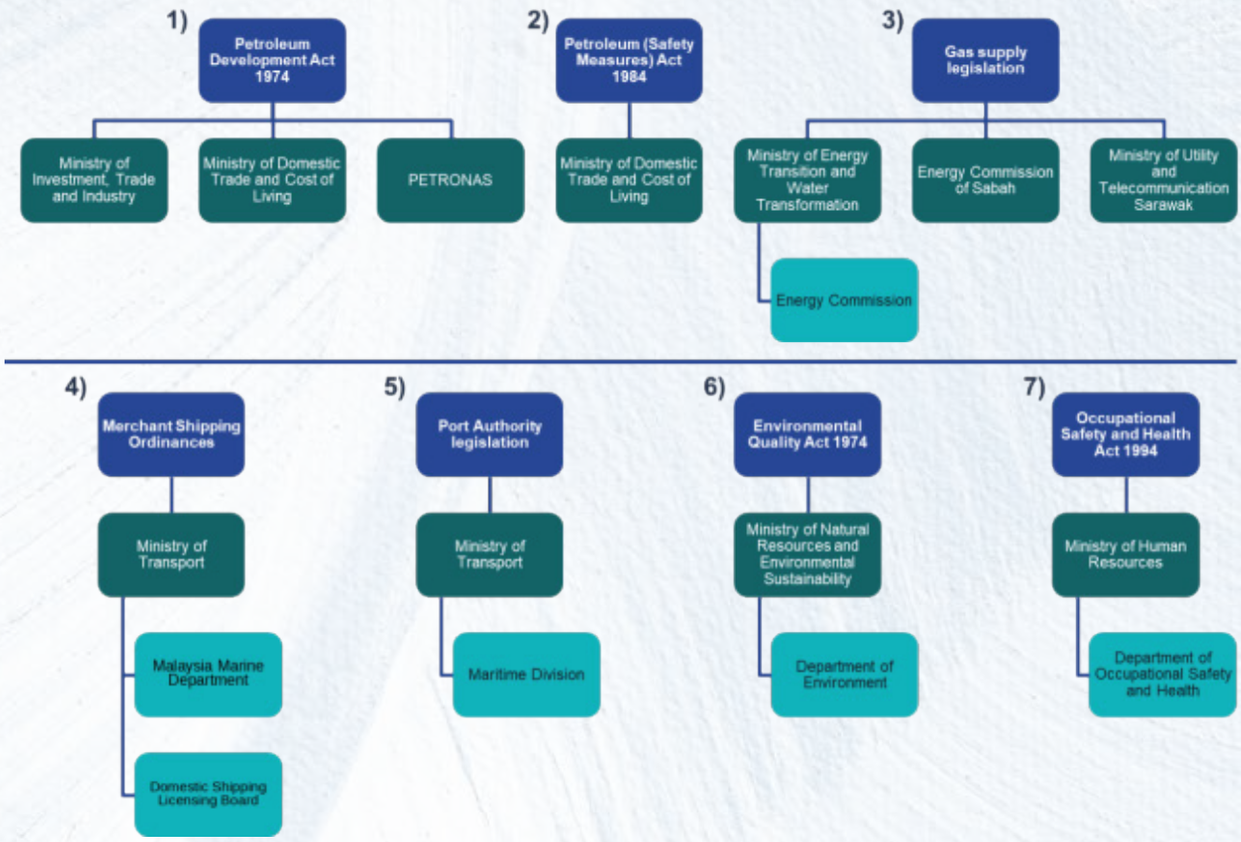
This section provides an overview of Malaysia's regulatory framework in relation to alternative maritime fuels, focusing on the challenges, gaps, and opportunities associated with liquefied natural gas (LNG), methanol, hydrogen and ammonia. The analysis spans the entire supply chain, from production and transportation to importation, storage, and bunkering operations. This section aims to highlight key considerations for alternative fuels that are poised to transform the maritime sector.

Biofuels are excluded from the scope of this analysis, as it is regulated by the Malaysian Biofuel Industry Act 2007. This legislation defines what constitutes a biofuel, establishes the Act as the prevailing law governing biofuels, assigns licensing and permitting authorities and processes, and sets up an enforcement mechanism. Under this legislation, biofuels are well-regulated.

Hydrogen is considered in this regulatory assessment primarily because of its role as an upstream feedstock and enabling energy carrier for the production of green methanol and green ammonia. Direct hydrogen bunkering is not treated as a near-term priority under this Roadmap because of current cost, infrastructure and technology constraints; however, relevant regulatory interfaces are retained where they affect the wider green-fuel supply chain.

An overview of the key pieces of legislation that underpinned the analysis, and the responsible entities is provided in Figure 5. Further detail on the pieces of legislation can be found in Appendix C: Brief Overview of Key Legislation.

Figure 5: Overview of key legislation and responsible entities



Each fuel is examined with a focus on its potential for adoption as a green bunkering fuel, including its environmental benefits, technological advancements, and the specific regulatory requirements or gaps that may influence its use. Insights from Adnan Sundra and Low, P4I's legal advisor for this activity, including their observations and recommendations, are integrated to provide a detailed understanding of the current regulatory landscape and potential areas for improvement.

The key fuel types covered include:

- LNG;
- Methanol;
- Ammonia; and
- Hydrogen (due to its role in the production of methanol and ammonia)

The regulatory framework assessment adopts a broad perspective, examining regulations across the supply chain. Key focus areas include:

- Bunkering operations;
- Production;
- Planning and construction of facilities;
- Transportation;
- Import;
- Handling and storage; and
- Pollution of sea and air, and climate change

Engagement with Adnan Sundra and Low has provided valuable insights into Malaysia's regulatory landscape for alternative fuels. Their recommendations identify regulatory gaps, opportunities for alignment with global trends, and actions needed to incentivize the development of green bunkering infrastructure.

Important to note is that the current regulatory framework assessment did not include review of the main principles of a responsible transition, such as skills development and job creation, social protection, green economy, and community engagement and consultation, highlighted in the Maritime Just Transition Taskforce's 10-point action plan, all of which are equally crucial in the regulatory landscape for green bunkering.

Although this document provides an overarching view of responsible transitions in the green bunkering roadmap, a comprehensive and strategic approach to assessing the aforementioned responsible transition elements in the regulatory framework is still required.

4.2. Bunkering operations

Bunkering operations, which involve the supply and transfer of marine fuels to vessels, are a critical component of the maritime industry. In Malaysia, these operations are governed by a complex regulatory framework that includes domestic legislation, international conventions, and oversight by port authorities. While the existing framework is well-established for traditional petroleum-based fuels, the transition to alternative green fuels such as methanol, ammonia, and hydrogen presents new challenges. This section explores the regulatory landscape for bunkering operations, highlighting its application to traditional fuels and identifying gaps and opportunities for accommodating green bunkering activities in Malaysia.

4.2.1. Traditional fuel bunkering

Traditional fuel bunkering operations are regulated primarily by the Petroleum Development Act (PDA), the Petroleum Regulations and Merchant Shipping Ordinances. These regulations form the backbone of Malaysia's existing framework for the storage, handling and distribution of petroleum-based fuels.

Under PDA, any entity wishing to market or distribute petroleum or petrochemical products must obtain permission from the Malaysian Prime Minister through an application to the Ministry of Domestic Trade and Cost of Living. This requirement also extends to bunkering supply and operations involving petroleum products.

While this framework provides clear regulatory oversight for traditional petroleum-based bunkering, it presents several challenges and gaps when applied to alternative fuels. For instance:

- The guidance provided under the PDA does not specify whether bunkering operations involving petrochemical products such as methanol and ammonia (derived from petroleum-based origins) also require approval.
- Methanol and ammonia that are produced from non-petroleum-based origins (e.g., green methanol or ammonia derived from renewable energy sources) are not regulated under PDA, creating a regulatory gap.

These gaps highlight the limitations of relying on traditional fuel regulations to govern the bunkering of alternative fuels. Without updates or new legislation, the regulatory framework may not be able to accommodate the unique safety, environmental and operational requirements of alternative green fuels.

4.2.2. Domestic Shipping Licence

Malaysia's domestic shipping licensing framework was updated on 1 September 2026 following the commencement of the Merchant Shipping (Amendment) Act 2017 [Act A1551] and the Merchant Shipping (Domestic Shipping Licence) Regulations 2026 [P.U. (A) 306/2026]. Ships engaged in domestic shipping, including bunkering services where the activity falls within domestic shipping, must comply with Part IIA of the Merchant Shipping Ordinance 1952 and the 2026 Regulations, subject to applicable statutory exemptions and permissions.

Under the 2026 Regulations:

- an owner or master of a Malaysian ship, or an agent of a permitted non-Malaysian ship, applies for a DSL to a domestic shipping officer;
- the domestic shipping officer processes the application and, where approved, issues the DSL;
- the licence is issued for the validity period and on the conditions specified in the licence; and
- renewal is not an entitlement and is treated as a new application; an application for renewal must be submitted not less than 14 days before the expiry of the licence.

The amended Ordinance preserves the general policy that domestic shipping is undertaken by Malaysian ships while allowing the Minister to permit a non-Malaysian ship to engage in domestic shipping subject to applicable conditions. The revised framework therefore provides a statutory mechanism for managing specialised vessel availability during the transition to green-bunkering services.

In the context of developing a green-bunkering ecosystem, the updated framework gives rise to several policy and operational considerations:

- **Readiness of Domestic Fleet Capacity:** The transition to fuels such as methanol and ammonia requires bunker vessels that are purpose-built or retrofitted to enhanced technical and safety standards. Where specialised Malaysian-flagged capacity is not yet available, the statutory mechanism for a permitted non-Malaysian ship provides a transition pathway, subject to Ministerial permission and applicable conditions.
- **Licensing Flexibility and Operational Continuity:** The 2026 framework allows the validity period and conditions of a DSL to be specified in the licence. For pilot projects and sustained green-bunkering services, licensing administration should provide predictable processing and renewal timelines consistent with the Regulations.
- **Safety and Technical Standards:** In addition to DSL requirements, MMD and the relevant authorities will progressively develop or adopt technical guidance and standards for green-bunkering vessels to address the specific safety, environmental and operational characteristics of alternative fuels.

4.2.3. Bunkering Permit and Current Application Guideline

Bunkering operations are subject to the Merchant Shipping Ordinances, applicable Malaysia Shipping Notices and other relevant statutory approvals. As at 8 September 2026, MSN 02/2025, Application Guidelines to Operate Bunkering Services 2025, is the current MMD guideline for bunkering-service applications and supersedes the earlier MSN 30/2011, MSN 03/2014 and MSN 08/2014. Applicants must comply with the requirements applicable to the proposed fuel, vessel, port and mode of operation.

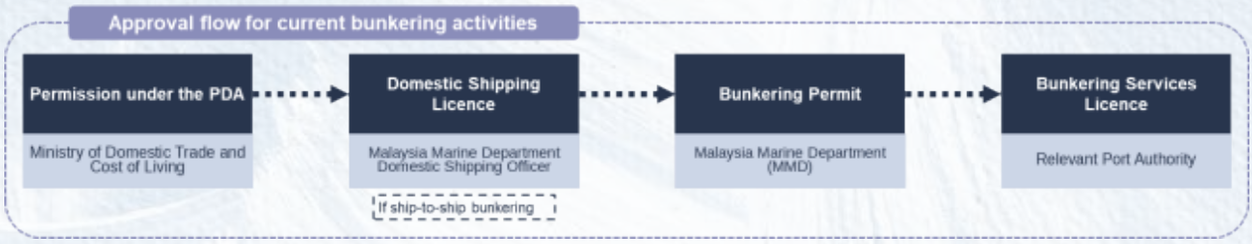
- A licence under the Petroleum Development Act.
- A Domestic Shipping Licence.
- Approval from the relevant Malaysian port authorities where the bunkering operations will take place.
- Several international pollution prevention certificates under the MARPOL Convention.

While these steps aim to ensure regulatory compliance and safety in traditional fuel bunkering, they expose critical challenges for green fuel adoption:

- Regulatory treatment of green fuels: existing petroleum-based approvals do not comprehensively address methanol and ammonia produced from non-petroleum pathways. The Roadmap therefore establishes actions to clarify the responsible authority, approval pathway and fuel-specific safety requirements.
- Multi-agency approvals: applicants may need approvals from several authorities depending on the fuel, vessel and location. The Roadmap prioritises process mapping, digitalisation and a coordinated one-stop mechanism to reduce unnecessary duplication while maintaining statutory safeguards.
- Keeping pace with fuel adoption: the regulatory framework will be progressively updated to incorporate emerging fuels, technologies and internationally agreed safety standards so that approval processes do not become a barrier to safe deployment.

Figure 6 illustrates the approval pathway identified through the regulatory review. The process will be updated as implementation of the 2026 domestic-shipping framework, the current MMD bunkering guideline and the Roadmap's licensing reforms progresses.

Figure 6: Bunkering operations approval process



Additionally, permit holders are required to comply fully with the following:

- The provisions of the Petroleum Development Act
- The Merchant Shipping Ordinances
- Applicable Malaysia Shipping Notices, circulars and guidance issued by MMD
- Safety measures prescribed by the MARPOL Convention and International Bunker Industry Associations

The Roadmap recognises that multiple statutory approvals may be required for bunkering operations. Implementation will focus on clearer sequencing, coordinated guidance and digitalisation so that applicants can navigate the process efficiently without weakening safety, environmental or other legal requirements.

The approval pathway will be periodically reviewed as new fuel types, operating models and national or international requirements emerge.

4.2.4. Port authorities

Port authorities are a key regulatory body for overseeing and facilitating safe and efficient bunkering operations. Through port by-laws, circulars, and notices, port authorities are empowered to issue standard operating procedures (SOPs) that govern the safety measures to be followed before, during, and after bunkering operations. These procedures provide critical guidance to ensure compliance with safety protocols and operational standards.

Port authorities will update existing SOPs or issue new procedures, circulars and notices where required for the unique handling and operational characteristics of alternative fuels. National coordination under this Roadmap will support consistency while allowing port-specific risk controls.

Additionally, the previous feasibility studies conducted for PTP have already identified its potential as a hub for sustainable maritime fuels. This, coupled with the Johor Port Authority's regulatory oversight, makes PTP uniquely placed to pioneer green bunkering operations compared to other Malaysian ports.

Clear and progressive regulations under the Johor Port Authority's oversight will attract investment and international partnerships, positioning PTP and other major federal ports in Malaysia as a key hub for green bunkering operations. The authority's leadership in this space could serve as a national standard, enabling other Malaysian ports to follow suit with cohesive and consistent regulations for alternative fuels. By streamlining operations and fostering collaboration, the Johor Port Authority can help Malaysia capitalize on the growing demand for green fuels, ensuring the safe and sustainable adoption of these technologies while maintaining competitiveness in the global maritime industry.

4.2.5. IMO Regulations and the SOLAS Convention

Malaysia implements SOLAS and relevant IMO requirements through the Merchant Shipping Ordinances and national instruments, including Malaysia Shipping Notices. The IGF Code provides the mandatory international safety framework for ships using gases or other low-flashpoint fuels. Methanol, ammonia and hydrogen also fall within relevant dangerous-goods and fuel-safety requirements according to their mode of carriage and use.

The IGF Code does not yet contain comprehensive prescriptive requirements for every emerging fuel. IMO has therefore developed fuel-specific interim safety guidance, including MSC.1/Circ.1621 for methyl/ethyl alcohol, MSC.1/Circ.1687 for ammonia and MSC.1/Circ.1701 for hydrogen. These instruments provide an up-to-date international basis for Malaysia's national implementation work.

Port of Tanjung Pelepas

The Johor Port Authority enforces the SOLAS Convention, including Chapter VII – Carriage of Dangerous Goods, at the Port of Tanjung Pelepas through the Johor Port Authority By-Laws. This means that vessels transporting methanol, ammonia, or hydrogen must comply with the safety requirements established under the SOLAS Convention.

Additionally, safety requirements outlined in the Johor Port Authority By-Laws for vessels carrying dangerous goods include:

- Compliance with the rules and regulations set out in the SOLAS Convention pertaining to the classification, storing, handling, labelling and marking of such dangerous goods;[8]
- The requirement to obtain the written permission of the Johor Port Authority (Tanjung Pelepas) and the licensed port operator (namely, Pelabuhan Tanjung Pelepas Sdn Bhd) prior to docking of the vessel at the wharf of the port; and
- Designation of place and condition to load or discharge dangerous goods.[9]

Malaysia's adoption of SOLAS provides an essential safety baseline. The Roadmap supplements this baseline by directing MMD and port authorities to operationalise relevant fuel-specific IMO guidance and develop the national procedures needed for bunkering and SIMOPS as alternative-fuel use expands.

While Malaysia's adoption of the SOLAS Convention ensures a baseline of safety for transporting dangerous goods, the regulatory gap for low flashpoint fuels such as methanol, ammonia, and hydrogen remains a significant challenge. Without adopting the IMO's interim guidelines or introducing specific regulations for these fuels, Malaysia risks being unprepared to handle the growing adoption of these alternative fuels in maritime operations. Furthermore, the Johor Port Authority's enforcement of these requirements at PTP demonstrates its readiness to oversee green bunkering activities, but additional regulatory clarity is needed to fully support the safe and efficient use of alternative fuels.

[8] *Section 42 of the Johore Port Authority (Tanjung Pelepas) By-Laws.*
[9] *Section 54 of the Johore Port Authority (Tanjung Pelepas) By-Laws.*

Policy and regulatory implications

- Malaysia's regulatory frameworks for traditional marine fuels are well established, with LNG supported by the IGF Code and existing domestic practice.
- The approval pathway for non-petroleum methanol and ammonia requires greater clarity, particularly where existing petroleum legislation does not apply.
- Bunker operators may still need to engage multiple authorities for approvals, licences and permits; the Roadmap addresses this through institutional designation, process streamlining and digitalisation.
- Port authorities remain key regulators of port-based bunkering operations and will develop or update operating procedures for alternative fuels in coordination with MMD and other competent authorities.
- Malaysia's national framework will continue to incorporate relevant international standards, including SOLAS, MARPOL, the IGF Code and fuel-specific IMO interim guidelines.
- Fuel-specific national implementation of IMO interim guidance, competency requirements and port procedures will be progressed under Strategic Actions 3 and 5 of this Roadmap.
- Malaysia's regulatory frameworks reference international standards and regulations for traditional fuels such as MARPOL.
- However, the SOLAS Convention does not currently address the use of methanol, ammonia and hydrogen as low flashpoint fuels. While methanol has been temporarily addressed through interim guidelines from the IMO, these have not yet been adopted into law in Malaysia.

4.3. Production

Fuel production in Malaysia is governed by both the Petroleum Development Act and the Industrial Co-ordination Act. Importantly, the Petroleum Development Act regulates the production of petroleum, or traditional marine fuel, and petrochemical products that are derived from petroleum-based origins, however where petrochemical products are not derived from petrochemical-based origins, the Petroleum Development Act does not apply. Separately, the Industrial Co-ordination Act regulates all manufacturing activities, regardless of the substance that is being produced.

4.3.1. Petroleum and Petrochemical Products

To be able to process or refine petroleum (including traditional marine fuel) and/or manufacture petrochemical products from petroleum-based or natural gas origins in Malaysia, it is mandatory to first gain permission from the Malaysian Prime Minister through the Ministry of Investment, Trade and Industry in accordance with the Petroleum Development Act and the Petroleum Regulations. It is important to note that methanol and ammonia derived from green processes are not regulated by the PDA. The PDA only applies to petrochemical products derived from petroleum-based or natural gas origins.

Additionally, hydrogen is not considered a petroleum or petrochemical product as per the Petroleum Development Act and, therefore, does not require permission from the Malaysian Prime Minister.

This gap in the PDA means that green fuels such as methanol, ammonia, and hydrogen are not subject to the same regulatory oversight as petroleum-based fuels. While this could reduce administrative burdens for producers of green fuels, it also creates uncertainty about safety, environmental compliance, and operational standards.

4.3.2. Non-Petroleum and Non-Petrochemical Products

The Industrial Co-ordination Act (ICA) regulates all manufacturing activities in Malaysia, regardless of the substance that is being produced. As a result, any individual producing marine fuel, traditional or alternative, is required to obtain a manufacturing licence from the Ministry of Investment, Trade and Industry. In summary, a manufacturing licence is required for the manufacturing of all fuel types including: traditional marine fuel, methanol and ammonia from petroleum-based or natural gas origins, methanol and ammonia not derived from petroleum-based origins and hydrogen.

While the ICA provides a broad framework that applies universally to all manufacturing activities, it does not account for the unique technical, safety, and environmental concerns associated with the production of alternative fuels such as hydrogen, green methanol, and green ammonia. This lack of specificity could lead to inconsistent safety standards and regulatory oversight, creating risks for both producers and consumers.

4.3.3. Safety Measures

The Petroleum Development Act and the Industrial Co-ordination Act primarily focus on regulating licensing requirements on individuals conducting production activities. Neither Act details specific safety measures or standards regarding the handling and storage of products once they have been produced. Instead, this area is regulated by the Petroleum (Safety Measures) Act, the Occupational Safety and Health Act and the Environmental Quality Act. A brief overview of each of these Acts role in regulating the handing and storage of marine fuel is provided below.

Petroleum (Safety Measures) Act 1984

The Petroleum (Safety Measures) Act was enacted to address the lack of legal requirements regarding safety measures and standards in the petroleum industry. It regulates various areas of the handling and storage of petroleum and petroleum products. This Act primarily comes under the jurisdiction of the Ministry of Domestic Trade and Cost of Living, with some areas falling under the jurisdiction of the Department of Occupational Safety and Health.

It is important to note that this Act does not extend its provisions to petrochemical products and non-petroleum products. Therefore, methanol, ammonia and hydrogen are not currently regulated by the provisions in this Act, resulting in a regulatory gap in safety measure standardisation for these alternative fuels.

Occupational Safety and Health Act

The aim of the Occupational Safety and Health Act is to provide a safe work environment through various health and safety requirements that owners and operators in all industries are required to meet. It is important to note that this Act does not apply to persons working on board ships as these are regulated by the Merchant Shipping Ordinances. This Act falls under the jurisdiction of the Department of Occupational Safety and Health.

The Occupational Safety and Health Act applies to industrial activity that includes “hazardous substances” which can be defined as those that are flammable, toxic, explosive or highly reactive. As such, this Act applies to production facilities that produce both traditional and alternative marine fuels such as methanol, ammonia and hydrogen.

In the future, this Act may require further refinement to appropriately consider any emerging risks associated with alternative fuels.

Approval and Environmental Impact Assessment

The Environmental Quality Act 1974 [Act 127] and its subsidiary legislation establish environmental-approval and EIA requirements for prescribed activities. Fuel-production, chemical, petrochemical and associated infrastructure projects must therefore be assessed against the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 and other applicable requirements, including the relevant project type and threshold. This framework applies alongside other planning, safety and licensing approvals.

Policy and regulatory implications

- Production of green fuels such as methanol and ammonia are well-regulated in Malaysia, the regulatory regime applies to traditional and alternative fuels.
- Current safety regulations apply to production facilities for green marine fuels.

4.4. Planning and construction of facilities

4.4.1. Construction and building

Planning permission is required before a fuel production storage facility can be constructed. It is important to note that planning permissions are subject to the local authority based on the location of the proposed facility.

Planning Laws

The administration of land use and planning falls under the jurisdiction of the relevant local authorities, a planning permission from the relevant local authority is required before any development of fuel production facilities can begin. The local authority that is responsible for granting planning permission depends on where the facilities are proposed to be developed, whether it is developed in Federal Territories or States. Where development is to take place in a State, the responsibility for the planning permission will also depend on whether it is within a municipal, district council or municipalities.

Other approvals

In addition to the planning permission outlined in the previous section, the construction of a facility may require other authorisations such as licences, approvals or permissions from relevant local authorities. These may include the following:

- Prior written permission and written notification for the construction of new buildings. Importantly, this includes docks, wharves, piers, jetties and other key pieces of infrastructure connected to the facility;
- A licence to carry out trade, business and industry related to petroleum products, flammable gas and dangerous goods as well as their storage and other liquid materials;
- Prior written permission to:
  - Lay pipes, mains and/or conduits through, across, over or under streets in a local area;
  - Construct buildings over a public sewer, connection pipe, public surface or storm water drain, culvert, water course, river or stream or any water main, electric cable or wire; and
- Approval to conduct earthworks, including excavation, levelling, filling, piling, foundation construction, tree felling or any other act that disturbs any land.

Additionally, the Merchant Shipping Ordinance outlines several requirements specifically relating to marine construction activities. This includes notifying MMD for any ship engaged in activities in Malaysian waters and the completion of marine risk assessments for marine activities involving ships.

Finally, some developments are also required to conduct a social impact assessment which is subject to the approval of the Department of Town and Country Planning. The aim of a social impact assessment is to study the direct social issues and impacts of construction activities.

The requirement for multiple approvals across various areas adds layers of bureaucracy and complexity to the construction process. The involvement of multiple authorities and jurisdictions can delay projects and increase costs, especially for green fuel facilities that require specialized infrastructure. Streamlining these approval processes would facilitate faster development of green energy projects and improve Malaysia's attractiveness for investment.

4.4.2. Safety and Health

There are several safety and health requirements for the construction building and installation of facilities, plants or equipment involved in fuel production and storage. These requirements are outlined in various pieces of legislation such as the Occupational Safety and Health Act and the Environmental Quality Act as well as subsidiary legislation. There are also potential gaps regarding the ways in which green bunkering is regulated by the two aforementioned Acts due to the new and unique nature of these operations, especially in the case of new green fuels and their associated infrastructure.

Occupational Safety and Health Act

The Occupational Safety and Health Act is a comprehensive piece of legislation which applies to both the construction and installation of any facility used in the production or storage or fuel. Individuals seeking to complete any construction activities must first provide a written notification to the Department of Occupational Safety and Health in instances where activities are expected exceed 30 working days or 500 person days. The Act ensures that safety standards and protections for workers are met when construction activities are occurring.

While the Act provides a solid framework for ensuring worker safety during construction, it does not specifically address the risks associated with green fuel infrastructure, such as hydrogen's flammability or ammonia's toxicity. As green fuel projects expand, the Act may require refinements or supplementary regulations to account for the unique safety challenges posed by alternative fuels, ensuring worker protection and operational safety.

Environmental Quality Act

The Environmental Quality Act (EQA), combined with its subsidiary legislation, regulates that specific maritime-related structures require an EIA. This EIA requires the prior approval of the Department of Environment. This would apply to the construction of structures such as onshore of offshore pipelines more than 30km in length or new ports or expansions which result in a 50% or more increase in handling capacity.

While the EQA ensures environmental oversight for large-scale infrastructure projects, it does not fully address the specific environmental risks posed by green fuel infrastructure, such as potential hydrogen leaks or ammonia spills. As green bunkering operations grow, the EQA and its subsidiary regulations may need updates to ensure that environmental risks unique to green fuels are adequately managed, minimising harm to ecosystems and surrounding communities.

Policy and regulatory implications

- There are a significant number of approvals, licences and permissions required from various Government or local authorities which can be quite complex. This may also result in the process to gain approval for construction quite time-consuming.
- There may be potential gaps in the Occupational Safety and Health Act and the Environmental Quality Act regarding the regulation of new green fuels and the infrastructure required for their production and storage.

4.5. Transportation

4.5.1. Laws on transportation

The transportation of fuels in Malaysia is governed by a combination of petroleum-safety, road, rail, merchant-shipping and gas-supply legislation. The Petroleum (Safety Measures) Act 1984 [Act 302] regulates specified petroleum activities, while the Gas Supply Act 1993 [Act 501] applies in Peninsular Malaysia, the Gas Supply Enactment 2023 applies in Sabah, and the Distribution of Gas Ordinance 2016 applies in Sarawak. Alternative fuels may also be subject to other transport and dangerous-goods requirements according to the mode of carriage.

It is important to note that these pieces of legislation only apply to the transportation of liquid petroleum and gas and therefore do not apply to petrochemicals and other chemicals such as methanol, ammonia and hydrogen. These substances are regulated by various other pieces of legal frameworks such as:

- The Merchant Shipping Ordinances
- Road Transport Act 1987 and dangerous-goods vehicle requirements
- The Land Public Transport Act
- Rail transport

This segmented approach to the regulation of transportation of liquid petroleum and gas, and petrochemicals and substances such as methanol, ammonia and hydrogen may result in inconsistencies or confusion when enforcing the relevant pieces of legislation. This is especially important to consider in the context of the transportation of green fuels for green bunkering activities.

4.5.2. Transportation by water

Petroleum (Safety Measures) (Transportation of Petroleum by Water) Regulations 1985

The Petroleum (Safety Measures) (Transportation of Petroleum by Water) Regulations sit under the Petroleum (Safety Measures) Act and the Ministry of Domestic Trade and Cost of Living is responsible for its enforcement. The Regulations were introduced to specifically govern the transportation of petroleum via water and as such, they do not apply to the transportation of methanol, ammonia or hydrogen, meaning that, currently, there is a key regulatory gap regarding the safe handling and transportation of alternative fuels. Consideration should be given to ensuring that the transportation of these substances is appropriately regulated in any new or adapted guidelines.

Merchant Shipping Ordinance 1952

As outlined in Section 4.2.5, Malaysia has adopted and implemented the SOLAS Convention through the Merchant Shipping Ordinance. Under the SOLAS Convention, methanol, ammonia and hydrogen are classified as “dangerous goods” as per the definitions provided by the IMO in the International Maritime Dangerous Goods Code and as such must be transported in accordance with the Convention.

There is the potential for ambiguity in the identification and classification of new alternative fuels such as methanol, ammonia and hydrogen under existing definitions such ambiguity and discrepancies may result in regulatory oversight and ultimately impacting safety.

4.5.3. Transportation by roads and railways

Roads

Road transport of petroleum-based and alternative fuels is governed by the applicable licensing regime together with the Road Transport Act 1987 [Act 333] and, in Peninsular Malaysia, the Land Public Transport Act 2010 [Act 715]. Commercial-vehicle licensing in Sabah and Sarawak is administered under the Commercial Vehicles Licensing Board Act 1987 [Act 334].

In Peninsular Malaysia, the Land Public Transport Agency (APAD) regulates relevant goods-vehicle licensing under its statutory jurisdiction. In Sabah and Sarawak, commercial-vehicle licensing functions are undertaken by the respective Commercial Vehicle Licensing Boards.

The Road Transport (Construction and Use) (Dangerous Goods Vehicle) Rules 2015 [P.U. (A) 263/2015], made under the Road Transport Act 1987, require dangerous-goods vehicles to meet specified construction and use requirements, including UN ECE Rule 105 and vehicle-design approval by the Director General of Road Transport. Implementation should continue to assess whether additional fuel-specific operational guidance is required for methanol, ammonia and hydrogen.

Rail transport

For Peninsular Malaysia, rail transport and related approvals are governed principally by the Land Public Transport Act 2010 [Act 715] and other applicable railway legislation. Any future rail movement of alternative fuels in Sabah or Sarawak will be assessed against the State and Federal legislation, licensing and safety requirements applicable in the relevant jurisdiction at the time of project development.

As rail and intermodal connectivity for alternative fuels develops, the responsible authorities will establish clear and coordinated requirements covering dangerous-goods safety, infrastructure interfaces, emergency response and consistency with national transport policy.

Road and rail requirements will be periodically reviewed to ensure that the specific hazards and operational characteristics of alternative fuels are adequately addressed as deployment increases.

The growing use of alternative fuels such as methanol, ammonia, and hydrogen poses unique safety and efficiency challenges for both road and railway transportation. Current regulatory frameworks and approval processes may need to be updated to address the specific requirements of these fuels, ensuring safe, efficient, and sustainable transport. Clear and coordinated guidelines are essential to align infrastructure development with national transport and safety policies, supporting the transition to greener energy.

Policy and regulatory implications

- Currently, there is a regulatory gap regarding the transportation of new green fuels such as methanol, ammonia and hydrogen as the current Petroleum (Safety Measures) (Transportation of Petroleum by Water). Current regulations only apply to petroleum.
- There may be gaps in the current legislation and regulations regarding the transport of dangerous goods by road relating to the unique characteristics and safety requirements surrounding methanol and ammonia.

4.6. Import

4.6.1. Import of petroleum and gas-based fuel

The import of petroleum into Malaysia is governed by the Petroleum Development Act and the Petroleum Regulations, which require permission from the Malaysian Prime Minister via an application to the Ministry of Domestic Trade and Cost of Living. This applies to petroleum-based methanol and ammonia but excludes non-petroleum-based methanol, ammonia, and hydrogen. The Gas Supply Act (Peninsular Malaysia), Gas Supply Enactment (Sabah), and Distribution of Gas Ordinance (Sarawak) are focused on gas transportation and do not apply to alternative fuels like methanol, ammonia, or hydrogen.

The reliance on petroleum-based definitions in current legislation creates regulatory inconsistencies and leaves a gap for non-petroleum-based chemicals and hydrogen, resulting in disparities in import controls.

The import of all goods, including methanol, ammonia, and hydrogen, is regulated by the Customs Act, which governs imports across transportation modes:

- **Water:** Goods must land at legal landing places with customs permission, and vessel masters must submit required information unless exempted.
- **Roads and Railways:** Imports must enter via prescribed locations and designated routes.
- **Pipelines:** Approval from the Director General of Customs is required, with conditions imposed at their discretion.

Current regulations may not fully address the import of non-petroleum-based alternative fuels like hydrogen, methanol, and ammonia, creating potential gaps in oversight and enforcement. Further clarity is needed to ensure these fuels integrate seamlessly into existing import procedures, particularly across different transportation methods, to avoid operational challenges and ensure consistent enforcement.

Policy and regulatory implications

- Import requirements outlined in the Petroleum Development Act and the Petroleum Regulations do not apply to non-petroleum-based chemicals, such as methanol and ammonia, and hydrogen potentially resulting in regulatory inconsistences and disparity in import controls
- Consideration may be required as to how alternative fuels integrate into the existing procedures outlined in the Customs Act, especially where there may be challenges with transporting new fuels across different transportation modes.

4.7. Handling and storage

4.7.1. Handling and storage of traditional marine fuel

The handling and storage of traditional marine fuel (derived from petroleum or natural gas) is governed by the Petroleum (Safety Measures) Act, overseen by the Ministry of Domestic Trade and Cost of Living. Occupational safety aspects of the Act are enforced by the Department of Occupational Safety and Health under the Ministry of Human Resources. Multiple enforcement bodies may lead to coordination challenges, impacting the consistent application of safety standards across storage facilities.

Individuals handling or storing traditional marine fuel must hold specific licences and comply with conditions related to storage and handling procedures.

4.7.2. Handling and storage of methanol, ammonia and hydrogen

The handling and storage of methanol, ammonia, and hydrogen are regulated by the Occupational Safety and Health Act, which is enforced by the Department of Occupational Safety and Health under the Ministry of Human Resources. These substances are classified as “hazardous substances” due to their flammable nature.

Key requirements include:

- Conducting risk assessments.
- Developing occupational safety and health policies and implementing risk control measures.
- Reporting accidents (e.g., explosions, fires) to the Department of Occupational Safety and Health.
- Ensuring that the design, construction, operation, and maintenance of storage facilities are safe and fit for purpose.

The Department of Occupational Safety and Health has issued guidelines that detail the construction and operation of storage facilities for hazardous chemicals, such as gas cylinders, drums, and bulk containers. These guidelines currently serve as the primary statutory framework for the large-scale storage of alternative fuels like methanol, ammonia, and hydrogen.

Environmental Impact Assessment

The Environmental Quality Act, enforced by the Department of Environment, governs pollution and waste discharge from industrial activities. Whether an Environmental Impact Assessment (EIA) is required for a storage or related facility depends on whether the proposed development falls within a prescribed activity and applicable threshold under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 and other relevant subsidiary requirements. Alternative-fuel facilities must therefore be assessed on the basis of the activity, scale, location and applicable legal thresholds, rather than fuel name alone.

Maritime Industry considerations

The regulation of handling and storage for alternative fuels in maritime contexts is fragmented:

- The Occupational Safety and Health Act applies to harbours of commerce or ports but does not extend to ship anchors. It also does not cover individuals working on ships governed by the Merchant Shipping Ordinances.
- The Petroleum (Safety Measures) Act regulates petroleum storage on land and vessels but does not cover methanol, ammonia, or hydrogen on vessels.

The Merchant Shipping Ordinance, through the adoption of the SOLAS Convention, regulates the carriage of dangerous goods, including alternative fuels, on ships. Separately, the Ministry of Transport governs the storage of oil and harmful substances at sea.

The fragmented regulatory framework for handling and storing traditional and alternative fuels creates potential gaps in oversight, especially in maritime settings. While the Occupational Safety and Health Act provides guidelines for land-based storage, its limited scope in maritime contexts and exclusion of ship anchors and workers governed by the Merchant Shipping Ordinances leaves significant regulatory gaps. Furthermore, the absence of mandatory Environmental Impact Assessments for non-petroleum-based fuel storage facilities could result in inconsistent environmental oversight and management. Clear, unified, and comprehensive guidelines are essential to address safety, environmental, and operational risks for alternative fuels across both land-based and maritime sectors, ensuring consistent enforcement and streamlined processes.

Policy and regulatory implications

- There may be challenges related to co-ordination of various government bodies and the enforcement of safety standards.
- There is a lack in official requirements regarding the design, construction and operation of large-scale storage facilities of alternative fuels.
- There is a regulatory gap in the lack of a requirement for individuals to gain the approval from the Department of Environment prior to the development of storage facilities for methanol, ammonia and hydrogen.
- There may be a need to increase clarity surrounding the regulation of the safety of workers at ports or on ships which may lead to confusion.
- The storage and handling of alternative fuels on vessels is currently a regulatory gap. Currently, there is a reliance on guidelines rather than enforceable standards.

4.8. Pollution of sea and air, and climate change

4.8.1. Pollution of sea and atmosphere

The main pieces of legislation which govern the prevention and control of pollution and the environment are the Environmental Quality Act and the Merchant Shipping Ordinances. Key aspects of these pieces of legislation are the requirement for EIAs and the prohibition of the discharge of hazardous substances and waste in Malaysian waters and atmosphere. The main governing body for environmental regulations and policies is the Ministry of Natural Resources and Environmental Sustainability (through the Department of Environment).

Emission and discharge into Malaysia waters

The Environmental Quality Act and Merchant Shipping Ordinances prohibit the discharge of hazardous substances, pollutants, or waste into Malaysian waters except under limited circumstances. Methanol, ammonia, and hydrogen are included in the definition of hazardous substances due to their toxic and hazardous nature and cannot be discharged in Malaysian waters without approval from the Department of Environment.

The Merchant Shipping (Liability and Compensation for Oil and Bunker Oil Pollution) Act 1994 [Act 515] establishes compulsory insurance or financial-security requirements for ships carrying in bulk more than 2,000 tonnes of oil and, for bunker-oil pollution, ships over 1,000 gross tonnage. The statutory regime is directed to oil and hydrocarbon bunker oil and does not establish an equivalent dedicated liability framework for non-oil alternative fuels such as methanol, ammonia or hydrogen. This creates a policy need to assess liability and financial-security arrangements for pollution incidents involving emerging fuels. Malaysia's implementation of MARPOL Annexes I, II and VI provides additional international controls over oil, noxious liquid substances and air pollution from ships.

Emission into the atmosphere

The Environmental Quality Act 1974 and the Environmental Quality (Clean Air) Regulations 2014 establish controls over emissions to the atmosphere from regulated activities and premises. Alternative fuels must be assessed against the applicable hazardous-substance, industrial-emission and licensing requirements according to the activity and facility concerned.

As alternative fuels become more prominent, Malaysia will review whether existing pollution, liability, monitoring and financial-security arrangements provide adequate coverage for their specific hazards and environmental consequences.

4.8.2. Climate Change Laws

Malaysia submitted its third Nationally Determined Contribution (NDC 3.0) to the UNFCCC on 24 October 2025. NDC 3.0 establishes an economy-wide absolute GHG emissions-reduction target of 15-30 MtCO2eq by 2035 from the national peak emissions level, comprising an unconditional reduction of up to 20 MtCO2eq and a further 10 MtCO2eq conditional on international support. Malaysia expects national GHG emissions to peak between 2029 and 2034 and strives to achieve the peak by 2030, subject to enabling conditions.

Policy update source: Malaysia NDC 3.0, submitted to the UNFCCC on 24 October 2025; NRES parliamentary updates, 2026. In April 2026, the Government also launched the National Carbon Market Policy (Dasar Pasaran Karbon Kebangsaan, DPKK), following Cabinet approval on 1 April 2026.

Malaysia's Federal climate-governance framework is continuing to evolve. NRES has been finalising the proposed National Climate Change Bill (Rang Undang-Undang Perubahan Iklim Negara, RUUPIN) as an overarching regulatory instrument for climate governance. Implementation of this Roadmap will remain interoperable with the final Federal climate legislation, DPKK, carbon-market arrangements, monitoring, reporting and verification requirements, and relevant State-level climate legislation as these instruments are operationalised.

Policy and regulatory implications

- Malaysia will assess whether compulsory insurance and financial-security requirements adequately cover pollution damage associated with non-oil alternative marine fuels, taking account of the existing framework under Act 515 and relevant international developments.
- Existing frameworks for hazardous-substance emissions and pollution control will be evaluated and updated where necessary to address the specific characteristics of alternative fuels.
- Green-bunkering regulation will be implemented consistently with NDC 3.0, DPKK and the evolving Federal and State climate-governance framework, while maintaining compatibility with future carbon-accounting, MRV and emissions requirements.

5. Governance, Implementation and Review

5.1. Governance and institutional coordination

MOT is the policy owner and coordinating ministry for this Cabinet-approved Roadmap. Implementation will follow a whole-of-government approach involving MMD, port authorities, relevant economic, trade, environment, occupational safety, customs, finance, energy, State and local authorities, together with port operators and industry. Each action will be implemented by the responsible authority in accordance with its statutory mandate and the applicable legal, financial and administrative framework.

MOT will establish or designate an inter-agency Green Bunkering Steering Committee to coordinate implementation, resolve cross-agency issues, maintain the implementation matrix and advise the Government on matters requiring further policy, fiscal or legislative decisions. Technical working groups will support the Committee on safety and standards, licensing and regulatory processes, infrastructure and investment, and responsible-transition outcomes.

5.2. Implementation principles

Safety first: implementation will not compromise maritime, occupational, public or environmental safety.

Technology neutrality with lifecycle integrity: fuels will be assessed by verified well-to-wake GHG performance, safety and commercial readiness rather than by fuel label alone.

Regulatory clarity and efficiency: requirements will be transparent, coordinated and proportionate, with unnecessary duplication progressively removed.

Investment and market readiness: infrastructure, skills and incentives will respond to credible demand and avoid locking Malaysia into pathways that are inconsistent with future international requirements.

Responsible transition: implementation will address workforce skills, inclusion, social protection, affected communities, accessibility and climate resilience.

5.3. Implementation matrix

The following matrix translates the nine strategic actions into the delivery framework for this Roadmap. Where an authority is to be formally designated as part of an action, MOT will coordinate the designation and update the matrix accordingly. Supporting stakeholders may be refined through implementation without changing the approved policy direction.

No.	Strategic action	Lead / coordinating agency	Key supporting stakeholders	Timeframe	Key deliverable / KPI
1	Designate the authority/ focal point for green-bunkering permissions and permits	MOT (coordination); authority to be formally designated	MMD; port authorities; relevant ministries	2026–2027	Formal designation and published approval pathway
2	Streamline licensing and approvals, including digitalisation and a one-stop mechanism	MOT / designated authority	Approving agencies; MMD; port authorities	2026–2028	Integrated process map; one-stop/digital pathway; reduced duplication

3	Operationalise current IMO interim safety and training guidance for alternative marine fuels	MMD	MOT; port authorities; DOSH; training institutions; industry	2026–2027	MSNs/guidance; readiness assessments; competency and training arrangements
4	Enable investment and infrastructure for green bunkering	MOT with MOF/ MITI and relevant economic authorities	MOF; MITI; port authorities; fuel producers; investors	2026–2029	Investment framework; infrastructure pipeline; demand, accessibility and market-readiness assessment
5	Coordinate national SIMOPS procedures for LNG, methanol and ammonia	MMD / port authorities	MOT; DOSH; port operators; PETRONAS; shipping lines	2026–2028	Nationally replicable SIMOPS procedures and validation exercises
6	Strengthen international cooperation, safety capacity and workforce skills	MOT / MMD	Training institutions; P4I and other partners; industry	2026–2029	Training plan; international partnerships; competency programmes
7	Undertake economic, social and environmental impact assessments	MOT with NRES/ DOE and relevant authorities	NRES/DOE; port authorities; communities; industry	2026–2028	Baseline and impact assessments; mitigation, accessibility and resilience actions
8	Establish monitoring, evaluation and learning for responsible-transition outcomes	MOT	Relevant ministries; port authorities; industry	2028–2029	Baseline, responsible-transition KPIs and periodic reporting mechanism
9	Review the long-term legal framework for clean and low-GHG fuels	Government-designated lead / inter-agency task force	MOT; AGC; relevant Federal and State authorities	2030 onwards	Legislative review and implementation of the preferred regulatory architecture

5.4. Monitoring, review and policy refresh

MOT will conduct an annual implementation review and a comprehensive policy refresh at least once every two years, or earlier where required by material changes in IMO regulations, national climate or energy policy, fuel availability, safety standards, market demand or technology. The implementation matrix will be maintained as a living management tool and updated following relevant Government decisions.

5.5. Policy safeguards

Nothing in this Roadmap displaces existing statutory responsibilities or approval requirements. Actions involving fiscal incentives, new regulatory powers, institutional mandates or legislation will be implemented through the relevant legal, financial and Government processes. The Roadmap will be implemented consistently with Malaysia's international obligations and domestic constitutional and jurisdictional arrangements.

6. Conclusion

This Roadmap establishes a policy pathway for Malaysia to strengthen its position in the emerging market for lower-GHG marine fuels and sustainable bunkering services. Malaysia's strategic location, established port infrastructure and maritime capabilities provide a strong foundation, but continued competitiveness will depend on regulatory clarity, safe operating standards, efficient approvals, credible lifecycle-emissions integrity, investment readiness and effective inter-agency coordination.

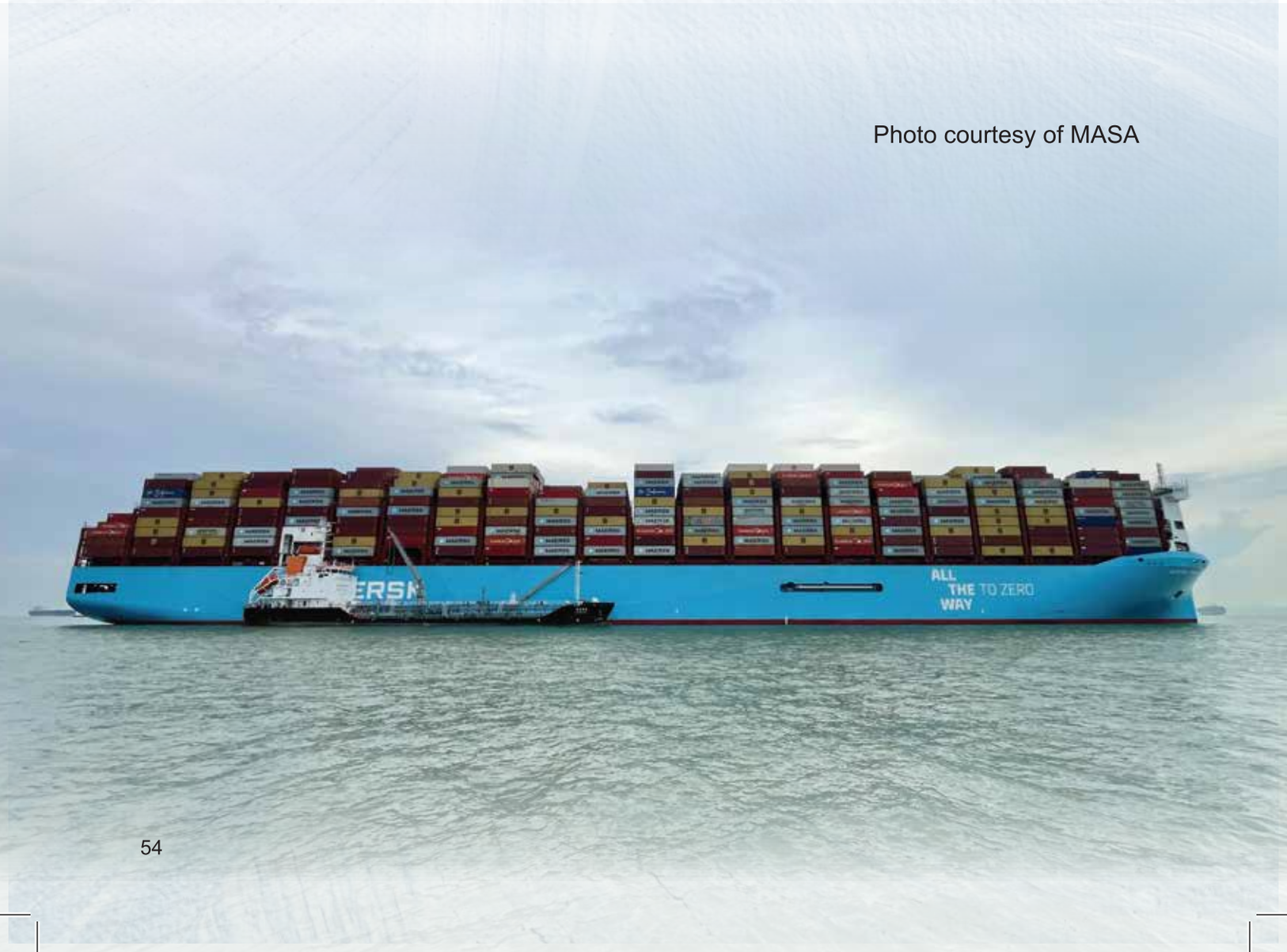
The Roadmap addresses the principal implementation gaps identified by the regulatory analysis: fuel-specific safety and SIMOPS procedures, clearer institutional responsibility, more efficient licensing and approvals, investment-ready infrastructure, workforce capability and coordinated environmental and social safeguards. The updated domestic-shipping framework that took effect on 1 September 2026 and the current MMD bunkering application guideline provide an immediate foundation for implementation.

Filling these gaps is critical for several reasons. A clear and streamlined regulatory framework will attract investments, improve safety, and reduce operational inefficiencies. It will also ensure that green bunkering aligns with Malaysia's environmental and economic goals, supporting the country's transition to a low-carbon economy. Developing the necessary infrastructure, such as specialised storage and bunker barges, will further position Malaysia as a hub for alternative fuels in the region.

The Roadmap prioritises nine strategic actions covering institutional responsibility, licensing reform, international safety guidance, investment and infrastructure, SIMOPS procedures, international cooperation and skills, impact assessment, responsible-transition monitoring, and a long-term legislative review. These actions will be implemented progressively through the governance and implementation framework set out in Section 5.

In conclusion, addressing these gaps is not just about meeting global standards but also about securing Malaysia's future as a competitive and sustainable maritime hub. With the right policies and investments, Malaysia can drive innovation, attract international partnerships, and play a major role in the global shift toward greener shipping.

Photo courtesy of MASA



Appendix A: Other Maritime Decarbonisation Initiatives

The table below highlights other key international initiatives and programmes aimed at supporting the global maritime industry's transition toward sustainability, decarbonisation, and inclusivity. These initiatives, driven by organisations such as the International Maritime Organization (IMO) and supported by various governments and stakeholders, address critical areas such as greenhouse gas (GHG) emissions reduction, capacity building, technology transfer, and the promotion of gender equality in the maritime sector. By leveraging these programmes, countries can enhance their technical expertise, develop policy frameworks, and implement innovative solutions to meet global maritime environmental and social standards.

Table 14: Relevant maritime decarbonisation initiatives by IMO and member states (non-exhaustive)

Initiatives	Details
INTERNATIONAL MARITIME ORGANIZATION Integrated Technical Cooperation Programme	Designed to assist Governments which lack the technical knowledge and resources that are needed to operate a shipping industry safely and efficiently.
GMN The Global MTCC Network Global Maritime Technologies Cooperation Centre Network	With support from the EU, this $11 million project established 5 TCCs in Asia, Pacific, Africa, Latin America, and Caribbean (2016-2022).
GREEN VOYAGE 2050 Green Voyage 2050	With support from Norway, this project (approximately $7.1 million, 2019-2023) supported countries to undertake assessments of maritime emissions in the national context, develop policy frameworks and National Action Plans to address GHG emissions from ships, and draft legislation to implement MARPOL Annex VI into national law.
GHG SMART Sustainable Maritime Transport Training Programme to Support the Implementation of the GHG Strategy	Funded by the Republic of Korea, this series of annual training programmes supports the implementation of the Initial IMO Strategy on Reduction of GHG Emissions from Ships by developing capacity in least developed countries and small island developing states.
IMOCARES Coordinated Actions to Reduce Emissions from Shipping	Funded by Saudi Arabia, IMO CARES started its implementation phase in 2023, with the ultimate objective to help link the global North and global South for the identification and trial of ready for market technology solutions, technology transfer, technology diffusion and uptake activities, pilot demonstration projects and green financing initiatives.
FUTURE SHIPPING Future Fuels and Technology for Low- and Zero-carbon Shipping Project (FFT project)	A $1.2 million partnership project between the Republic of Korea and IMO, designed to support GHG reduction from international shipping by providing technical analysis to the Organization in support of policy discussions held in the MEPC.

Appendix B: Key Stakeholders

Ministry of Transport

The Ministry of Transport (MOT) of Malaysia is a federal government ministry responsible for various key functions. These include formulating and implementing policies related to land transport, logistics, maritime, and aviation, as well as regulating compliance with legislation, service quality, and safety standards.[10]

The MOT is specifically responsible for developing regulations, safety standards, and guidelines for bunkering operations. It works closely with port authorities to ensure adherence to these standards. Additionally, the MOT has the authority to develop regulations for the safe use of alternative marine fuels such as methanol, ammonia, and hydrogen, if required.

Within MOT, several departments and agencies play a direct role in green bunkering. These include the Malaysia Marine Department (MMD), the Land Public Transport Agency (APAD), the Road Transport Department and the domestic-shipping licensing framework under Part IIA of the Merchant Shipping Ordinance 1952. The Domestic Shipping Licensing Board also continues to perform its statutory functions under the amended Ordinance.

Malaysia Marine Department

The Malaysia Marine Department (MMD), operating under the Ministry of Transport, is tasked with overseeing the administration of shipping and ports, as well as managing maritime affairs within Malaysian waters.[11]

In relation to bunkering operations, MMD is responsible for enforcing the Merchant Shipping Ordinances. These ordinances cover a wide range of requirements, including ship registration, personnel health and safety, passenger ship construction standards, maritime transport safety and security, and maritime pollution controls. As part of its enforcement of the Merchant Shipping Ordinances, MMD also implements the SOLAS Convention for the carriage of dangerous goods.

Under the Merchant Shipping Ordinances, MMD issues Malaysia Shipping Notices and other maritime guidance. Current bunkering-service applications are governed by the applicable legislation and MSN 02/2025, Application Guidelines to Operate Bunkering Services 2025. MMD also administers domestic-shipping licensing through the statutory framework that took effect on 1 September 2026.

Additionally, MMD plays a role in overseeing the planning and construction of maritime facilities. Any vessels undertaking activities such as cable and pipe laying or marine construction (e.g. jetties and wharves) within Malaysian waters must provide notification to MMD.

Furthermore, under the Merchant Shipping Ordinances, the Ministry of Transport has the authority to establish rules governing the storage of oil and other harmful substances at sea.

Land Public Transport Agency

The Land Public Transport Agency is an agency under the MOT, responsible for planning policies, programmes, and strategies related to land-based public transport. This includes oversight of rail, bus, and taxi services, as well as the transportation of goods via rail and road.

Through licensing requirements, the Agency regulates the transportation of goods on land vehicles such as:

- Containers;
- Cargo trucks; and
- Bulk tankers.

In the states of Sabah and Sarawak, this responsibility falls under the jurisdiction of the Commercial Vehicle Licensing Board of Sabah and Sarawak.

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[10] *Ministry of Transport Malaysia, 2025, Introduction To MOT*
[11] *Malaysia Marine Department, 2025, Malaysia Marine Department*

APAD's jurisdiction is in Peninsular Malaysia and includes the regulation and planning of relevant goods transport by road and rail under the Land Public Transport Act 2010 [Act 715]. Commercial-vehicle licensing in Sabah and Sarawak is administered by the respective Commercial Vehicle Licensing Boards under Act 334. These authorities will be relevant to the safe land transport of alternative marine fuels and associated equipment.

Domestic Shipping Licensing Board

The Domestic Shipping Licensing Board remains a statutory body under Part IIA of the Merchant Shipping Ordinance 1952. Following the commencement of the Merchant Shipping (Amendment) Act 2017 [Act A1551] and the Merchant Shipping (Domestic Shipping Licence) Regulations 2026 [P.U. (A) 306/2026] on 1 September 2026, DSL applications are processed by appointed domestic shipping officers, who issue or refuse licences in accordance with the Ordinance and the 2026 Regulations. The Domestic Shipping Licensing Board Regulations 1981 [P.U. (A) 27/1981] were revoked. The Board continues to perform its statutory functions under the amended Ordinance, including the control and general direction of domestic shipping and advising the Minister.

Ministry of Investment, Trade and Industry

The Ministry of Investment, Trade and Industry is a Ministry of the Malaysian Government and is responsible for implementing investment, trade and industrial policies, creating employment opportunities for Malaysia's workforce and driving Malaysia towards a developed nation. [12]

Under the Petroleum Development Act, individuals who wish to engage in the processing or refining of petroleum or the manufacturing of petrochemical products require permission from the Malaysian Prime Minister. As the Ministry of Investment, Trade and Industry is responsible for overseeing these activities, the Ministry is also responsible for facilitating applications for this approval.

Separately, all manufacturing activities, regardless of the substance produced, require a manufacturing licence which is also issued by the Ministry.

The Ministry of Investment, Trade and Industry will also be key in generating incentives for the production and use of alternative green fuels. For example, previously the Malaysian government has introduced a tax incentive scheme for the production of chemicals, including, but not limited to, methanol, ammonia and hydrogen. Organisations that undertake this activity are able to benefit from either:

- Pioneer status with a 70% income tax exemption for five years; or
- A 60% investment tax allowance on qualifying capital expenditures within five years.

These incentives position the Ministry as a key driver in fostering the growth of alternative green fuel industries in Malaysia.

Ministry of Natural Resources and Environmental Sustainability

The Ministry of Natural Resources and Environmental Sustainability aims to:

- Preserve and conserve forest areas, biodiversity, and geological heritage while managing mineral resources optimally, sustainably and responsibly;
- Protect and manage the environment, drive climate action and catalyse green growth; and
- Strengthen land administration and management while expanding spatial information networks.[13]

The Ministry also oversees the Department of Environment, which contributes to the regulation of bunkering processes by ensuring compliance with environmental standards. This role is particularly important as Malaysia advances its green bunkering initiatives, requiring stringent oversight to mitigate potential environmental risks associated with alternative fuels such as methanol, ammonia, and hydrogen.

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[12] *Ministry of Investment, Trade and Industry, 2025, Vision, Mission, Corporate Philosophy, Objectives and Functions*
[13] *Ministry of Natural Resources and Environmental Sustainability, 2025, Corporate Information*

NRES is also leading Malaysia's evolving climate-governance framework. Malaysia submitted NDC 3.0 in October 2025, and the Government launched the National Carbon Market Policy (DPKK) in April 2026 following Cabinet approval. NRES has also been finalising the proposed National Climate Change Bill (RUUPIN). These developments are directly relevant to lifecycle-GHG accounting, carbon-market interfaces and future emissions requirements for green bunkering.

Department of Environment

The Department of Environment is a department under the Ministry of Natural Resources and Environmental Sustainability and is responsible for the implementation and monitoring of environmental regulations and policies.

Under the Environmental Quality Act and its subsidiary legislation, the Department oversees the approval process for the development or construction of facilities related to oil and gas, as well as the production of chemicals and petrochemicals in specific circumstances. It also grants approval for the construction of certain maritime structures.

In addition, the Department regulates the discharge of substances and pollutants into Malaysian waters. Where necessary, it issues licences for the emission or discharge of harmful substances, ensuring compliance with environmental standards and protecting Malaysia's marine ecosystems.

Ministry of Domestic Trade and Cost of Living

The Ministry of Domestic Trade and Cost of Living aims to promote the development of a viable, competitive and sustainable domestic economy. [14]

The Ministry is responsible for enforcing the Petroleum (Safety Measures) Act, as well as the Petroleum (Safety Measures) (Transportation of Petroleum by Water) Regulations 1985. The enforcement of the Petroleum (Safety Measures) (Transportation of Petroleum by Pipelines) Regulations 1985 has been delegated to the Department of Occupational Safety and Health.

Importers of petroleum and petrochemical products are required to obtain permission from the Malaysian Prime Minister through an application to the Ministry. Additionally, the marketing and distribution of petroleum and petrochemical products, including bunkering supply and operations, fall under the Ministry's jurisdiction as outlined in the Petroleum Development Act. Permission from the Ministry is therefore required to conduct bunkering or supply petroleum-based fuels.

The Ministry's role is central to ensuring that bunkering operations and the distribution of petroleum-based fuels comply with Malaysia's safety and regulatory standards. As the country transitions to alternative fuels such as methanol, ammonia, and hydrogen, the Ministry's regulatory oversight will be critical in supporting the safe and efficient adoption of these new fuel sources, ensuring alignment with national economic and sustainability goals.

Ministry of Human Resources

The Ministry of Human Resources is responsible for various areas, including skills development, labour, occupational safety and health, trade unions and industrial relations among others. Within the Ministry, the Department of Occupational Safety and Health plays a key role in regulating the storage and handling of fuels which has direct relevance to bunkering operations.

Department of Occupational Safety and Health

The Department of Occupational Safety and Health (DOSH) is a department under the Ministry of Human Resources and enforces the Occupational Safety and Health Act 1994 [Act 514]. The Act, as amended and in force from 1 June 2024, applies broadly to workplaces but excludes work on board ships governed by the Merchant Shipping Ordinances. Maritime occupational-safety interfaces therefore require close coordination between DOSH and MMD, particularly for bunkering operations that involve both shore-based and shipboard personnel. DOSH also has responsibilities for relevant plant, hazardous-chemical and petroleum-pipeline safety requirements.

[14] *Ministry of Domestic Trade and Cost of Living, 2025, Background Information*

Additionally, as outlined in Section 3, the Department has been entrusted to enforce the Petroleum (Safety Measures) (Transportation of Petroleum by Pipeline) Regulations 1985 by the Ministry of Domestic Trade and Cost of Living. Its responsibilities in this area include:

- Conducting inspections of storage and handling facilities;
- Reviewing and assessing the safety of design and operation of sites that store petroleum; and
- Establishing and enforcing standards for labelling petroleum containers.

As Malaysia moves toward the adoption of alternative fuels such as methanol, ammonia, and hydrogen, the Department's enforcement of safety standards will be essential in managing potential risks associated with these fuels. This oversight helps maintain workplace safety, operational reliability, and alignment with Malaysia's broader sustainability and energy transition goals.

Ministry of Plantation and Commodities

The Ministry of Plantation and Commodities is responsible for overseeing the development of the agri-commodity plantations and industries.[15] One of its primary responsibilities is enforcing the Biofuel Industry Act, which governs the regulation of biofuels separately from petroleum and petrochemical products.

This includes the regulation of biofuels used as marine fuels. This process of obtaining permission to conduct bunkering operations using biofuels begins with this Ministry, ensuring that such activities are subject to clear and established regulatory oversight.

The Ministry's role is significant in supporting the transition to alternative, sustainable fuels in Malaysia. By providing a distinct regulatory framework for biofuels, the Ministry ensures that biofuel usage, including for bunkering, is well-regulated and aligns with the government's sustainability goals.

Port Authorities

Malaysia's port-governance framework comprises Federal and State legislation, port-specific statutes and the Ports (Privatization) Act 1990 [Act 422]. Key instruments relevant to the ports considered in this Roadmap include:

- Port Authorities Act 1963 [Act 488];
- Penang Port Commission Act 1955 [Act 140];
- Ports (Privatization) Act 1990 [Act 422] and its current Schedule; and
- Sarawak's Port Authorities Ordinance 1961 [Ord. No. 1/61], including the Bintulu Port Authority (Sarawak) framework following the transfer of Bintulu Port management to the Sarawak Government with effect from 1 September 2026.

The Ports (Privatization) Act 1990 provides the Federal framework for licensing port operators in respect of ports within its Schedule. The Schedule was amended in 2026 in connection with the transfer of Bintulu Port to Sarawak jurisdiction.

Port authorities are empowered under their respective legal frameworks to issue by-laws, circulars, notices and operating procedures governing port safety and operations. These instruments are directed to relevant port users, including shipowners, masters, agents, terminal operators and bunker suppliers.

Following the Federal-State transition arrangements and the termination of the Bintulu Port Authority Act framework at the end of 31 August 2026, management of Bintulu Port transferred to the Sarawak Government with effect from 1 September 2026. The Bintulu Port Authority (Sarawak) framework operates under Sarawak's Port Authorities Ordinance 1961.

[15] *Ministry of Plantation and Commodities, 2024, Ministry Profile*

For green bunkering, port authorities will continue to develop and enforce port-specific safety and operating requirements, coordinated where appropriate through the national framework under this Roadmap.

Port authorities play a crucial role in maintaining safe and efficient port operations, including bunkering. Their operational experience and regulatory powers will be central to the national roll-out of fuel-specific SOPs, SIMOPS procedures, emergency arrangements and port-readiness assessments.

Industry

Industry comprises a broad community of stakeholders that will play a central role as green bunkering becomes operational and expands in Malaysia. For the purposes of this Roadmap, industry includes non-government stakeholders involved directly or indirectly in the production, importation, storage, handling, transportation, supply and use of green marine fuels, as well as the operation of ships, ports, terminals and associated maritime and logistics infrastructure.

The industry stakeholder group therefore extends beyond individual fuel suppliers, terminal operators and shipping lines. It also includes industry associations representing shipowners, shipping lines and agents, bunker suppliers and operators, energy companies, logistics providers and other participants across the maritime fuel supply chain. PETRONAS, PETROS and other State-owned enterprises (SOEs), are also included within this category where they participate commercially in the relevant fuel and infrastructure markets.

As demonstrated through LNG and methanol bunkering initiatives at Malaysian ports, industry stakeholders have a critical role in establishing fuel supply chains, investing in infrastructure, identifying operational requirements and developing safe and standardised bunkering procedures. Shipowners and shipping lines are equally important as demand-side stakeholders, as their vessel deployment, fleet investment and fuel procurement decisions will influence the type, scale and location of alternative-fuel demand in Malaysia.

Industry associations will also provide an important mechanism for structured consultation between Government and the wider maritime and energy industries. Their participation will be particularly important when developing technical requirements, operational procedures, licensing arrangements, safety standards and future regulatory measures for green bunkering.

The industry stakeholders identified in this Roadmap are representative of the organisations expected to contribute to the development of green bunkering in Malaysia across LNG, methanol, biofuels, ammonia and other emerging low- and zero-GHG marine fuels. The list is not exhaustive and should continue to evolve as new fuels, technologies and market participants emerge

Appendix C: Brief Overview of Key Legislation

Petroleum Development Act 1974 [Act 144]

The Petroleum Development Act is the main piece of legislation that regulates petroleum and its development. The Act is accompanied by several underlying regulations. As part of the Act, a national oil and gas company was established, PETRONAS, which has exclusive rights and powers to explore and use Malaysia's petroleum resources.

Another key aspect of the Act is that approval from the Malaysian Prime Minister is required for several prescribed activities including:

- The exploration, exploitation, winning and obtaining of petroleum as well as the supply of equipment and facilities that support these activities;
- The processing or refining of petroleum or the manufacturing of petrochemical products; and
- The marketing or distribution of petroleum or petrochemical products.

Due to the specific focus of the Act on petroleum and petrochemical products, there may be legislative gaps for the regulation of alternative fuels such as methanol, ammonia and hydrogen.

Petroleum (Safety Measures) Act 1984 [Act 302]

The Petroleum (Safety Measures) Act is the main piece of legislation that regulates safety requirements surrounding the transportation, storage and use of petroleum. It is supported by the Petroleum (Safety Measures) (Transportation by Pipelines) Regulations and the Petroleum (Safety Measures) (Transportation by Water) Regulations. As mentioned in Section 4, the specific focus of the legislation and its regulations may indicate a key gap in the applicability to methanol, ammonia and hydrogen.

Gas Supply Act 1993 [Act 501], Gas Supply Enactment 2023 (Sabah) and Distribution of Gas Ordinance 2016 (Sarawak)

The Gas Supply Act in Peninsular Malaysia, the Gas Supply Enactment in Sabah and the Distribution of Gas Ordinance in Sarawak, work together to regulate the supply and distribution of gas in Malaysia, specifically via pipelines to domestic consumers. These pieces of legislation include requirements for licensing, the control of supply pipelines and installation, among others.

Similar to the potential limitations of the Petroleum Development Act and the Petroleum (Safety Measures) Act, due to the specific focus of the Gas Supply Act, Gas Supply Enactment and the Distribution of Gas Ordinance on gas, there may be gaps in the regulation of new alternative fuels.

Merchant Shipping Ordinance 1952 and the Merchant Shipping Ordinances 1960 of Sabah and Sarawak

Malaysia's merchant-shipping framework includes the Merchant Shipping Ordinance 1952 and the Merchant Shipping Ordinances 1960 of Sabah and Sarawak. The Merchant Shipping Ordinance 1952 was materially updated for domestic shipping by the Merchant Shipping (Amendment) Act 2017 [Act A1551], which came into operation on 1 September 2026, together with the Merchant Shipping (Domestic Shipping Licence) Regulations 2026 [P.U. (A) 306/2026].

These Ordinances regulate matters including ship registration, safety, construction, maritime transport, pollution and the domestic application of international maritime requirements. For alternative fuels, the Roadmap provides for progressive national implementation of relevant SOLAS, MARPOL, IGF Code and fuel-specific IMO interim guidance. The 2026 domestic-shipping reforms also replace the former 1981 domestic-shipping licensing regulations with the current statutory licensing framework.

Port legislation

Federal port authorities and licensed operators are principally governed by the Port Authorities Act 1963 [Act 488], the Penang Port Commission Act 1955 [Act 140] where applicable, and the Ports (Privatization) Act 1990 [Act 422]. Following the Federal-State transition arrangements, management of Bintulu Port transferred to the Sarawak Government with effect from 1 September 2026 and the port now operates within the applicable Sarawak State port-authority framework.

Port authorities may issue by-laws, circulars, notices and operating procedures under their respective legal frameworks. These instruments will be updated as necessary to address the specific safety and operational requirements of alternative marine fuels.

Environmental Quality Act 1974 [Act 127]

The Environmental Quality Act 1974 [Act 127], as amended, provides the principal Federal framework for preventing, abating and controlling pollution and includes EIA and discharge-control requirements through its subsidiary legislation. The Environmental Quality (Amendment) Act 2026 [Act A1793] came into force on 31 July 2026. Alternative-fuel projects must be assessed against the Act, the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 and other applicable subsidiary requirements according to the activity and threshold concerned.

Occupational Safety and Health Act 1994 [Act 514]

The Occupational Safety and Health Act 1994 [Act 514], incorporating the amendments that came into force on 1 June 2024, is the principal law governing occupational safety, health and welfare at work. The Act excludes work on board ships governed by the Merchant Shipping Ordinances, making coordination between DOSH and MMD important where bunkering operations involve both port-based and shipboard activities. The Act and its subsidiary regulations also provide relevant controls for hazardous chemicals, major industrial hazards, plant and construction work.

Appendix D: Relevant Global and Regional Maritime Decarbonisation Frameworks

There are several global and regional decarbonisation frameworks that are relevant to Malaysia as it moves towards implementing green bunkering operations. These include frameworks established by the IMO as well as ASEAN and the EU.

The 2023 IMO GHG Strategy establishes the international shipping sector's decarbonisation ambition and indicative checkpoints. The draft IMO Net-Zero Framework remains under consideration and is not yet legally binding. As an IMO Member State and a Category (c) Council member for the 2026-2027 biennium, Malaysia will continue to participate actively in IMO deliberations and maintain domestic regulatory readiness for internationally agreed measures.

IMO overview and GHG Strategy

The International Maritime Organization (IMO), established in 1948, serves as the global authority for maritime safety, security, and environmental performance. As a specialised agency of the United Nations, the IMO develops regulatory frameworks that are adopted and implemented by its members, covering all aspects of international shipping, including safety, ship design, operation, and disposal. The IMO's regulations apply to all ships registered under member states, ensuring compliance through inspections and enforcement by flag states.

Malaysia has been a Member State of the IMO since 1971 and is a member of the IMO Council under Category (c) for the 2026–2027 biennium. Category (c) comprises States not elected under Categories (a) or (b) that have special interests in maritime transport or navigation and whose election helps ensure representation of the world's major geographic areas. Malaysia's Council membership strengthens its ability to contribute actively to IMO deliberations on maritime safety, environmental protection and shipping decarbonisation.

IMO's current decarbonisation architecture combines measures already in force, including energy-efficiency and carbon-intensity requirements, with the 2023 IMO GHG Strategy and ongoing negotiations on the draft Net-Zero Framework. The draft Framework is intended to add a global marine fuel standard and a GHG emissions pricing mechanism if adopted.

The Fourth IMO GHG Study 2020 highlighted that shipping accounted for 2.89% of global anthropogenic GHG emissions in 2018, with projections indicating that emissions could rise significantly by 2050 if no action is taken. To address this challenge, the IMO adopted its GHG Strategy and serves as a framework for the IMO Member States, outlining a future vision for international shipping, the desired goals for reducing GHG emissions, and guiding principles.[16]

The 2023 IMO GHG Strategy envisages a reduction of total annual GHG emissions from international shipping by at least 20%, striving for 30%, by 2030 compared with 2008; and at least 70%, striving for 80%, by 2040. It also sets an ambition for net-zero GHG emissions from international shipping by or around, i.e. close to, 2050. These targets, together with measures already in force and the draft mid-term measures, create a progressively stronger signal for lifecycle-GHG reductions in marine fuels.

IMO Net-Zero Framework

The IMO Net-Zero Framework was approved by MEPC 83 in April 2025 as draft amendments to MARPOL Annex VI. It comprises two linked elements: a global marine fuel standard based on lifecycle GHG fuel intensity and a GHG emissions pricing mechanism. Formal adoption was considered at the second extraordinary session of MEPC in October 2025, but the session was adjourned. At ISWG-GHG 22, held from 1 to 4 September 2026, Member States continued work on concerns relating to the draft amendments and deferred detailed implementation-guideline work to ISWG-GHG 23, scheduled for 23-27 November 2026, ahead of MEPC 85 on 30 November-3 December 2026. The adjourned extraordinary MEPC session is scheduled to resume on 4 December 2026, subject to discussions at MEPC 85. Accordingly, at the time of publication, the Framework remains in draft form and is not legally binding.

Policy update source: International Maritime Organization (IMO), ISWG-GHG 22, 1-4 September 2026; status current as at 8 September 2026.

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[16] *International Maritime Organization, 2023, 2023 IMO Strategy on Reduction of GHG Emissions from Ships*

The draft Net-Zero Framework is a major international regulatory development for the future economics and environmental performance of marine fuels. Malaysia will maintain regulatory readiness while avoiding domestic assumptions that prejudge the final text, implementation guidelines or compliance timetable.

MOT and MMD will maintain an active regulatory watch and update national requirements when internationally agreed measures are adopted. Domestic regulation will also support credible lifecycle-GHG certification, traceability and emissions accounting so that Malaysia can respond efficiently to future IMO requirements.

A central feature of IMO's emerging regulatory architecture is lifecycle GHG accounting. This reinforces the need for Malaysia's green bunkering framework to distinguish between fuel types and fuel-production pathways and to support credible certification, traceability and well-to-wake emissions accounting. The environmental value of LNG, methanol, ammonia, hydrogen and biofuels cannot be determined by fuel name alone.

Malaysia will continue to support LNG bunkering where it meets applicable safety, lifecycle-emissions and commercial requirements, while ensuring that longer-term regulation remains technology-neutral and compatible with increasingly stringent lifecycle-GHG standards. Regulatory readiness will also be developed for low- and zero-GHG methanol, ammonia, sustainable biofuels and other emerging options.

International pilot activity in ports such as Rotterdam, Singapore and other major bunkering hubs demonstrates the pace of change in alternative-fuel deployment. Malaysia will use international experience, domestic pilots and IMO developments to strengthen regulatory readiness, infrastructure planning and investment confidence without locking the country into a single fuel pathway.

Relevant ASEAN regional frameworks

ASEAN Green Ship Strategy (GSS)

In alignment with the Paris Agreement and UN Sustainable Development Goals, the ASEAN Member States (AMS) adopted the Green Ship Strategy (GSS) at the 25th ASEAN Transport Ministers Meeting (ATM) in November 2019 (in cooperation with Japan)., This Strategy aims to promote the use of environmentally friendly ships, in particular conventional ships, to minimise the adverse impacts of climate change from GHG emissions. While the Strategy does not set a numerical goal of GHG reduction, it is intended to facilitate information sharing on ASEAN Member States' national policies to encourage the use of green ships. AMS regularly share their respective national policies as well as green ship and port initiatives through the Maritime Transport Working Group (MTWG) meetings. The implementation of this Strategy is coordinated by the ASEAN Secretariat and supported by the various national maritime authorities within the AMS to cascade the initiatives at the national level.

ASEAN Blue Economy Framework

ASEAN Leaders adopted the ASEAN Leaders' Declaration on the Blue Economy in October 2021, and subsequently the ASEAN Blue Economy Framework in September 2023. The Framework reinforces AMS' dedication to regional collaboration in the blue economy, promoting its priorities to enhance value creation, resilience, inclusivity, and sustainability. Recognising the critical role of ASEAN waters to the region's economy and environment, the "Blue Strategy 1: Blue Conservation Management" under the Framework presents an approach to managing marine ecosystems while promoting sustainable development.

This strategy is particularly relevant to maritime decarbonisation efforts in the ASEAN region, as it emphasises the need for integrated management practices that reduce greenhouse gas emissions and enhance environmental sustainability in maritime activities. As mentioned, implementing a neutral carbon balance in the context of the blue economy is closely aligned with the goals of the Paris Agreement and nationally determined contributions, which can be undertaken by assessing emissions, carbon sequestration, and applying blue carbon in line with nationally determined contributions to support blue growth. Another key aspect of the Blue Strategy is the emphasis on increasing resilience and strengthening disaster risk management. The strategy advocates for the application of nature-based solutions to protect coastal environments and communities, which aligns with maritime decarbonisation by promoting ecosystem resilience. Healthy ecosystems are better equipped to withstand the impacts of climate change, thereby reducing the vulnerability of maritime infrastructure and operations to extreme weather events.

A Guide to a Just and Inclusive Energy Transition in ASEAN

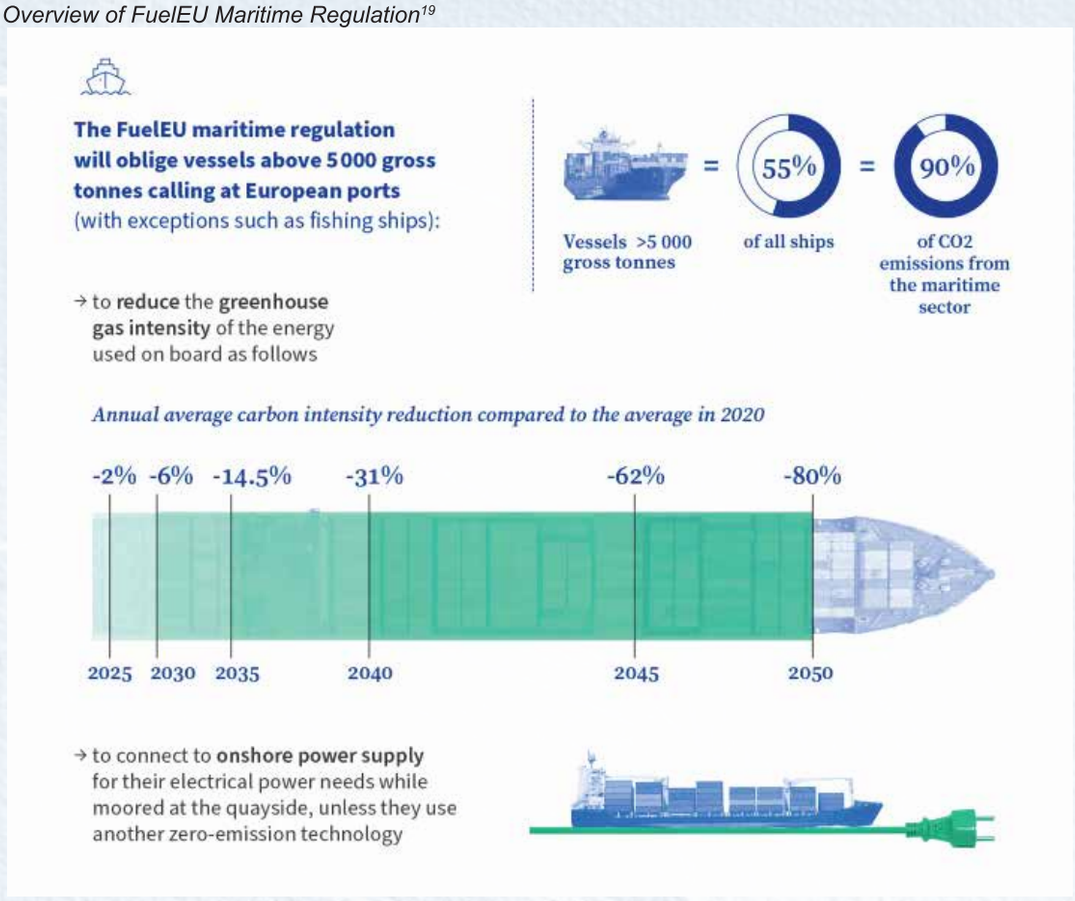
ASEAN's Guide to a Just and Inclusive Energy Transition was developed as part of ASEAN's Plan of Action for Energy Cooperation (2026 - 2030), outlining the main principles for ASEAN member states in the transition to decarbonisation.[17] These include: accessibility, fair distribution of costs and benefits, widest inclusion and participation, gender equity, and intergenerational equity, to name a few. The Guidance highlights inclusive governance and protection of disadvantaged groups as part of five priority sectors, including energy and employment.

European Union (EU)

FuelEU Maritime Regulation (Regulation (EU) 2023/1805)

The FuelEU Maritime Regulation supports the transition towards more sustainable maritime transport by mandating the reduction in yearly average greenhouse gas intensity of the energy used onboard by ships in the EU, through the gradual uptake of renewable and low-carbon fuels and technologies.[18]

Figure 7: Overview of FuelEU Maritime Regulation[19]

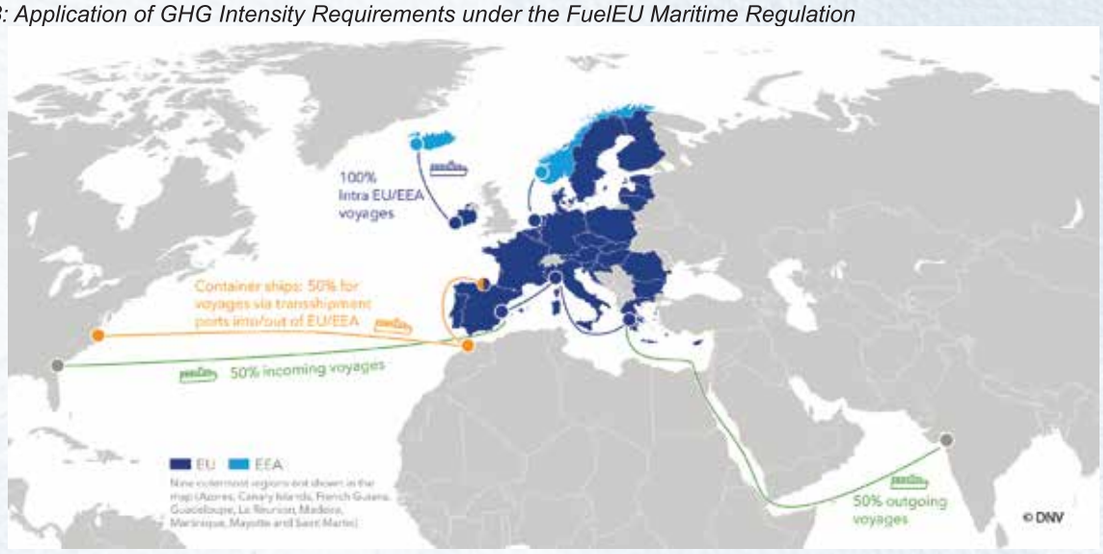


In force since 1 January 2025, the Regulation applies to all commercial ships above 5,000GT calling at ports across the EU/European Economic Area (EEA) and promotes a level playing field amongst stakeholders in the maritime value chain, e.g., shipping companies, competent authorities, verifiers, accreditation companies, port authorities, equipment manufacturers, fuel suppliers, and bunkering operators.[20] It establishes two (2) core obligations for vessels calling at EU ports:[21]

[17] *ASEAN Center for Energy, 2025, A Guide to a Just and Inclusive Energy Transition in ASEAN*
[18] *European Commission, 2024, FuelEU Maritime Regulation: Q&A on implementation*
[19] *European Commission, 2025, Decarbonising maritime transport – FuelEU Maritime*

1. GHG Intensity Reduction: There are specific targets for reduction of the yearly average GHG intensity of the energy used on board by ships, set in 5-year steps, ranging from 2% in 2025 to 80% in 2050. This Requirement applies to 100% of energy used on voyages and port calls within EU/EEA, and 50% of the energy used on voyages into and out of the EU/EEA (illustrated in Figure 8).[22]
2. Mandatory Use of Alternative Power Sources in Ports: Ships must use either onshore power supply (OPS) or zero-emission technologies while at berth.

Figure 8: Application of GHG Intensity Requirements under the FuelEU Maritime Regulation



The Regulation mandates various compliance steps for shipping companies and shipowners, as illustrated in the timeline below.[23]

Figure 9: Timeline for FuelEU Maritime Compliance

2024

31 August 2024 (or within two months of calling at an EU port):
Monitoring Plan Submission - Submit a FuelEU Monitoring Plan for each ship in the fleet, to be assessed by an independent verifier

2025

1 January 2025:
Monitoring Requirements - Record data (e.g., ports of departure and arrival, connection to onshore power supply or exceptions, electricity received through onshore power supply, emission factors, substitute energy consumption, ice class information for each ship's arrivals and departures at EU ports

2026

Starting from **31 January 2026:**
Annual Reporting - Provide a ship-specific 'FuelEU report' to the verifier (for verification and calculation of results) by 31 January each year, starting in 2026 (after the end of the first reporting period)

In addition, it requires passenger and container ships above 5,000GT to comply with zero emissions at berth (connection to onshore power supply or use of Zero Emissions Technologies) from 2030, when at berth for more than two hours (with exceptions):

- For Alternative Fuels Infrastructure Regulation-covered EU ports: Compliance with zero emissions at berth requirement from **1 January 2030**.
- For all EU ports with onshore power supply: Compliance with zero emissions at berth requirement from **1 January 2035** (or earlier as of 1 January 2030 at the discretion of Member States).

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[20] *European Commission, 2025, Questions and Answers on Regulation (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport, and amending Directive 2009/16/EC*
[21] *European Commission, 2025, Questions and Answers on Regulation (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport, and amending Directive 2009/16/EC*
[22] *DNV, 2025, FuelEU Maritime.*
[23] *European Commission, 2025, Decarbonising maritime transport – FuelEU Maritime*

While the FuelEU Maritime Regulation is primarily an external regulation focused on the EU, its implications will reshape global shipping markets and impact Malaysia. Many international shipping companies, particularly those headquartered in the EU or call at EU ports, will be required to comply with these regulations. This will influence their vessel order books and operational strategies. As these companies adapt to the new standards, they could prioritise investments in fleets that meet the FuelEU requirements, leading to a shift in demand for greener technologies and alternative fuels. This transition will likely extend to their operations in Malaysia, where compliance with these regulations will be essential for maintaining access to EU ports.

Moreover, Malaysia's strategic position along major shipping routes, including at PTP, makes it a critical hub for international shipping operations. Many shipping companies that are invested in Malaysian port infrastructure will seek to enhance their facilities to align with FuelEU requirements, such as incorporating onshore power supply and zero-emission technologies. This investment not only supports compliance but also positions Malaysia as a leader in sustainable maritime practices in the region. As the global shipping industry increasingly prioritises environmental sustainability, Malaysia stands to benefit from these developments, attracting further investment and enhancing its competitiveness in the international shipping market.

Implications for Malaysia

- Malaysia will maintain a regulatory environment that promotes fuels and energy carriers capable of delivering credible lifecycle-GHG reductions, including green ammonia and e-methanol, while retaining flexibility for other compliant technologies and fuel pathways.

- Green-bunkering regulation and implementation will align, where relevant, with the principles in ASEAN's Guide to a Just and Inclusive Energy Transition, including accessibility, participation, fair distribution of costs and benefits, gender equity and protection of vulnerable groups.

- Malaysia will support investment in port infrastructure and operational capability that enables Malaysian ports and shipping services to respond to international requirements, including FuelEU Maritime and future IMO measures, where commercially and technically justified.



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