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Logistics and Trade Facilitation
11th Session**

Maritime Transport in Times of Polycrisis

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**Maritime Singapore
Decarbonisation Efforts**

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Maritime Singapore Decarbonisation Efforts

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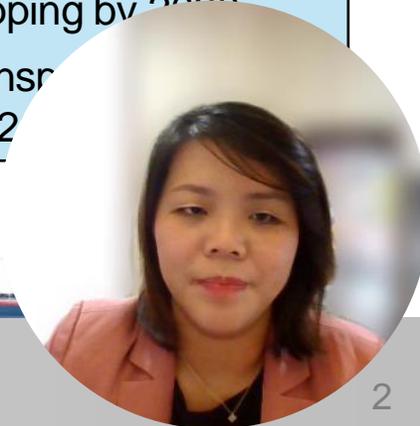
Context Setting

- In Oct 2022, Singapore announced the raising of its national climate target to achieve net zero emissions by 2050
- In July 2023, IMO adopted revised GHG strategy



Revised 2023 IMO GHG Strategy

- International shipping GHG emissions reduction targets (compared to 2008):
 - At least 20% (striving for 30%) by 2030
 - At least 70% (striving for 80%) by 2040
 - Net-zero by or around, i.e. close to 2050
- Uptake of zero/near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5% (striving for 10%) of the energy used by International Shipping by 2030
- Reduce CO2 emissions per transport work unit by at least 40% by 2030, compared to 2008



**Port
Terminals**

**Domestic
Harbour Craft**

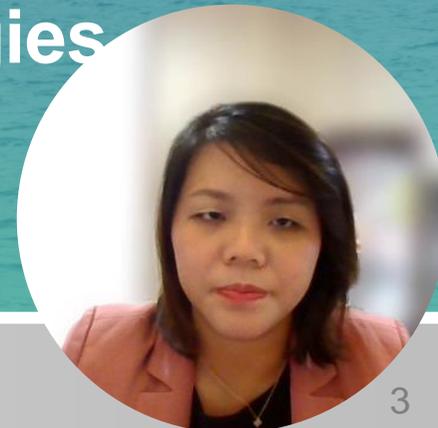
**Future Marine Fuels &
Energy Efficiency
Technologies**

Maritime Singapore's Decarbonisation Initiatives: Key Focus Areas

**Maritime Singapore
Green Initiative**

**International
Collaborations**

**Energy Efficiency
Technologies**



Port Terminals



Reducing emissions from port terminals

Singapore's port terminals will transit towards a low-carbon future, through the adoption of cleaner energy, automation and digitalisation. By 2030, our port terminal operators aim to collectively achieve at least 60% reduction of total emissions from port operations as compared to 2005 levels, and to reach net zero emissions by 2050.



Tuas, Sustainable Port of the Future

A key design feature of Tuas port is **sustainability**. Examples include:

- **Green Buildings and Energy Efficiency**

- The Tuas Maintenance Base Administrative Building is a Green Mark Platinum Super Low Energy Building.
- The building uses 58% less energy compared to similar-sized structures and generates solar energy to offset its electricity consumption.

- **Automated and Intelligent Operations**

- Tuas Port is designed to be automated and intelligent, utilising technologies like AI, automation, and digitalisation to optimise port operations.
- digitalPORT@SGTM enhances port operations' efficiency and reduces ship turnaround time.

- **Energy-efficient Operations**

- Electrified equipment, automation, and intelligent management contribute to reducing overall energy consumption.

- **Smart Grid**

- Smart grid management systems are employed to optimise energy consumption and distribution across the port's operations.

- **Future Plans**

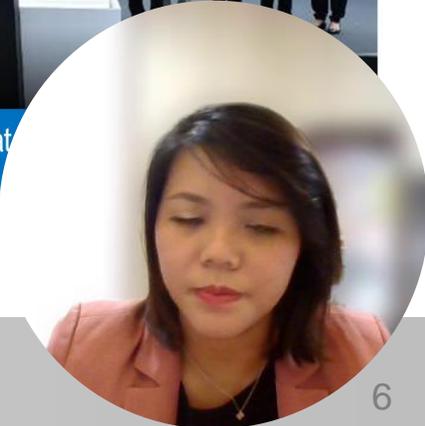
- MPA aims to develop a charging infrastructure implementation masterplan by 2025 to support electric vessels plying our domestic waters.



A key design feature of Tuas Port will be sustainability



PM Lee Hsien Loong at Tuas Port,



Domestic Harbour Craft



Cutting emissions from domestic harbour craft



Looking ahead

2030

2050

From 2030 onwards, **new harbour craft** operating in our port waters must be **fully-electric**, be capable of using **B100 biofuels**, or be compatible with **net-zero fuels** such as hydrogen

Harbour craft sector is required to achieve **net zero emissions by 2050**

Fully Electric Harbour Craft

Charging Infrastructure

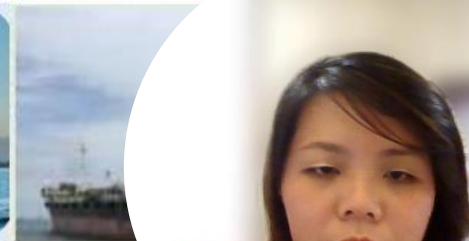
Passenger Craft (<12pax)

Lighters

Passenger Craft (>12pax)

Tugboat

Bunker Tug



Cutting emissions from domestic harbour craft

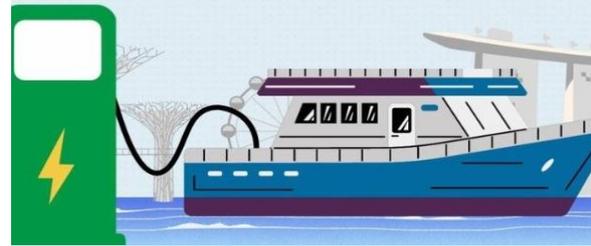
Full-Electric Harbour Craft



- **First full-electric ferry** started operations in 2023
- Expression-Of-Interest (EOI) to **design and promote adoption of full-electric harbour craft (e-HC)** – 11 proposals shortlisted

Charging Infrastructure

Identifying most feasible areas for e-HC Charging Stations



- Development of charging infrastructure standards
- Charging infrastructure masterplan to study optimal deployment of charging points, using modelling
- Call For Proposal to submit proposals to **develop, commission, maintain and operate** e-HC charging points – 3 concepts selected for pilot

Financing and Insurance



- Call for **financing and insurance proposals to support early adopters of eHCs** – 20 financing and insurance proposals received
- Insurance proposals for **info sharing, training, assurance** as mechanism for **price insurance** p

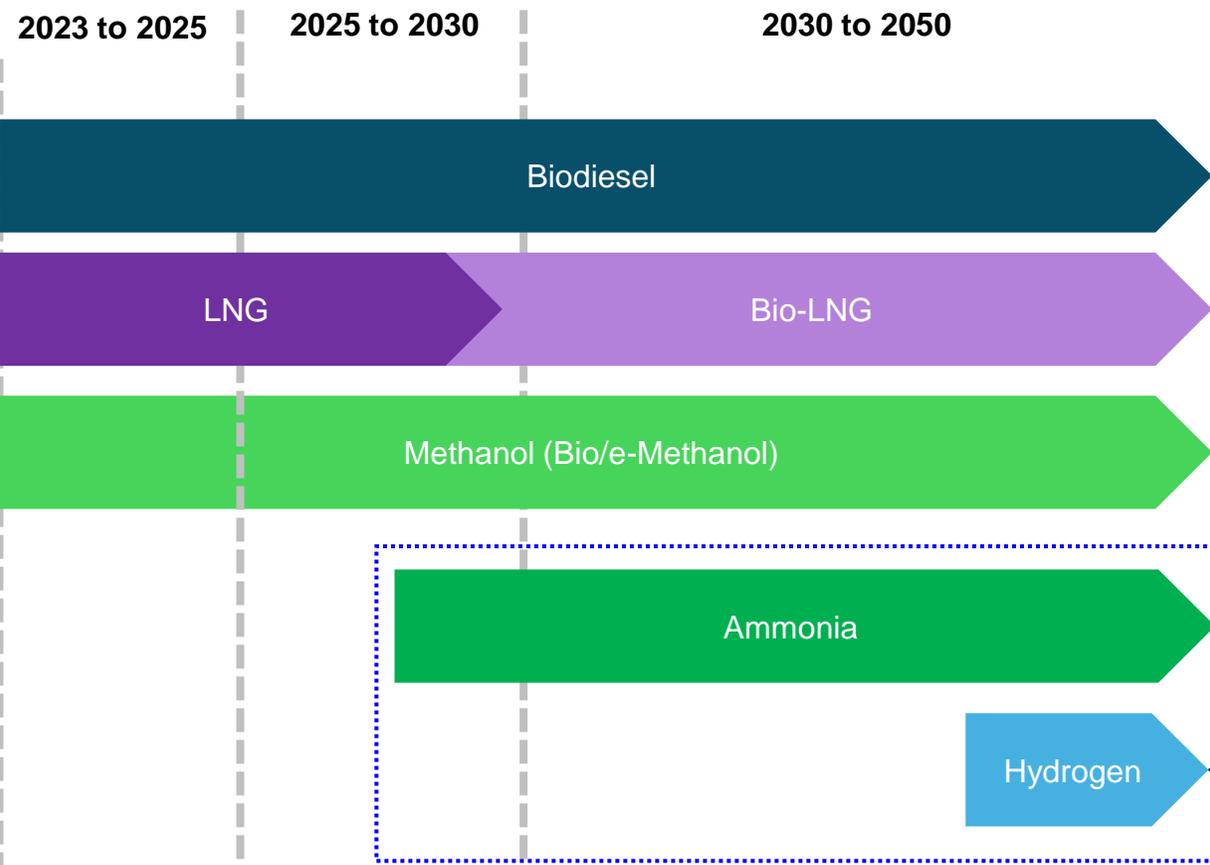


Future Marine Fuels and Energy Efficiency Technologies



A multi-fuel transition is likely for the maritime industry

Projected timeline for readiness as a marine fuel



LNG. Likely interim or transition fuel for shipping in the near term, until other alternative fuels come online.

Biofuels. May continue to be a part of the fuel mix in 2050 (eg: renewable diesel, bio-LNG produced from biogas).

Methanol. Gaining traction in the near-term, with increasing orders of methanol-fuelled ships.

Ammonia. Could be **most adopted maritime fuel in the mid to long term**, pending the commercialisation of ammonia engines, development of safety standards, regulations, ammonia bunkering infrastructure and training.

Hydrogen. May come online in the long term as direct maritime fuel. Maritime-specific hydrogen technology, supply chain, regulations and safety standards are still in development. In the interim, hydrogen is expected to play a role as feedstock in the production of alternative fuels.



Factors that will determine the future maritime energy mix may include: supply availability, cost, fuel technology maturity, safety and standards, regulations, supply chain and infrastructure development, competition with other sectors for fuels (eg: aviation).

Enabling a multi-fuel transition: Methanol

Expression of Interest (EOI) for the Supply of Methanol as a marine bunker fuel

- In Dec 2023, MPA issued an EOI to invite interested parties to submit proposals for the development of end-to-end methanol bunkering solutions in Singapore from 2025.



Standards Development

- **Working Group on standard development** for methanol bunkering to develop a Technical Reference for methanol bunkering in Singapore that covers custody transfer requirements for delivery

Emergency Response / Table-top Exercises / Mitigation Measures

- **Table-top exercise (TTX):** Organised with the **International Chemical and Oil Pollution Conference and Exhibition (ICOPCE) 2023**. Reviewed existing safety measures and standards, identified potential gaps and new safeguards, strengthened cross-agency coordination for an effective response to a methanol spill incident.
- **HAZID/HAZOP Workshop.** Organised in May 2023 with methanol bunkering trial partners, working group members and relevant government agencies to develop prevention, control and mitigation methods.



Milestones for Methanol Bunkering

- **World's First Ship-to-Containership Methanol Bunkering Operation:** Conducted safely and successfully in the Port of Singapore in July 2023.
- **Safety Measures:** Safety zone established, response vessels positioned, and environmental, metocean, and safety risk modeling conducted by various research organizations and institutions.
- **Methanol Detection:** Drones equipped with methanol detectors and infrared cameras deployed for additional detection points.
- **Customised Methanol Firefighting Program:** Conducted as part of bunkering operation preparations.



Milestones for Methanol Bunkering

- **Successfully completed the first simultaneous methanol bunkering and cargo operation (SIMOPS) in Singapore on 27 May 2024 at the new Tuas Port**
- **Trials:** Mass flow metering (MFM) system for methanol, together with the use of digital bunkering
- **Successful ship-to-ship methanol bunkering** of close to 1,340 metric tonnes of blended methanol for the *Stena Prosperous* on 24 May 2024



First simultaneous methanol bunkering and cargo operation



Ship-to-ship bunkering of blended methanol for



Enabling a multi-fuel transition: Ammonia

Joint Industry Projects (JIP)



Standards Development

- Drafting Technical Reference for ammonia bunkering.

Request for Proposal (RFP) to develop ammonia power generation & bunkering solutions

- MPA and the Energy Market Authority (EMA) have shortlisted 2 bidders for pre-Front End Engineering Design (pre-FEED) study. Aim to select lead developer by Q1 2025.

Request for Information (RFI) to quote shipping and insurance cost of ammonia

- Identify ammonia demand hubs between source country and Singapore, demand aggregation to reap economies of scale.

Safety studies with Institutes of Higher Learning (IHLs) / Research Institutes (RIs)

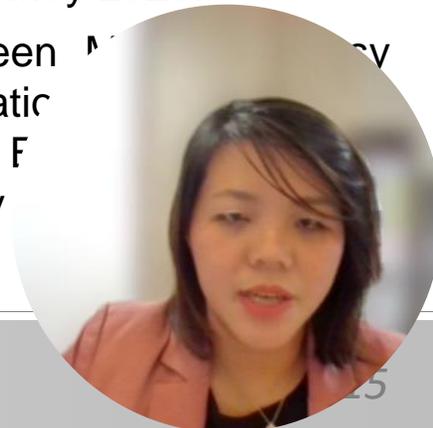


Emergency Response/Table-top Exercises

Managing accidents involving ammonia as fuel for ships



- Workshop featuring 2 accidental release scenarios and involving 70 participants from 12 countries in May 2023.
- Collaboration between MPA, MAREC of France, Innovatic, and MPA for the support of the F “Enhancing Security With Asia”.



Key milestones of the ammonia fuel trial

- **World's First Use of Ammonia as a Marine Fuel in a Dual-Fuelled Ammonia-Power Vessel:** Conducted on board the Singapore-flagged *Fortescue Green Pioneer*
- **Safety preparations:** HAZID and HAZOP workshops to identify potential risks during fuel transfer and engine trials. Onboard drills and training conducted to assess operational readiness and preparedness of crew during an incident.
- **Plume modelling:** Ammonia plume model developed by research institutes*.
- **Safety Measures:** Fuel trial conducted over seven weeks, tests done in phases. Safety zone established, response vessels positioned, monitoring via drone.



*Agency for Science, Technology and Research's Institute of High Performance Computing (A*STAR's IHPC)

*Nanyang Technological University's Maritime Energy and Development Centre (MESD)

*Technology Centre for Marine, Singapore

*National University of Singapore's Tropical Marine Science Institute



MPA is also working to equip seafarers and port workers with the skills to handle these new fuels

- MPA will establish a Maritime Energy Training Facility (METF), supported by the industry, for training of the global maritime workforce in the operation of vessels using clean marine fuels.
- Aims to train approximately 10,000 seafarers and other maritime personnel by the 2030s.
- METF will support the joint IMO–Maritime Just Transition Task Force (MJTTF) project to establish training standards for seafarers in decarbonising shipping.
- The Singapore Maritime Academy (SMA) introduced training course on handling methanol as ship fuel.
 - Covers operational and safety procedures during methanol refueling, developed by MPA following the first-ever ship-to-containership methanol bunkering operation in Singapore in July 2023.
 - Includes a practical methanol firefighting component addressing both shipboard and terminal fire scenarios.



Wind propulsion technology

Singapore welcomed three-wind propelled vessels in 2023

- The Berge Olympus, a 210,000 DWT dry bulk carrier retrofitted with four large rigid sails known as WindWings, made a port call in Singapore during its voyage between Asia and Brazil.
- Recently, the Port of Singapore has developed safety protocols and welcomed other wind-powered vessels. These include the Singapore-flagged Pyxis Ocean, equipped with WindWings, and the Panama-flagged Sea Zhoushan, fitted with Norsepower rotor sails.



Engagement with stakeholders in wind propulsion technology

- MPA organised a roundtable discussion at SMW2024, bringing together wind propulsion system manufacturers such as AYRO, ANEMOI and Bound4Blue and research institutes (A*STAR's Institute of High Performance Computing (IHPC) and the Technology Centre for Offshore and Marine, Singapore (TCOMS)) to share insights on the role of digitalisation to augment wind propulsion technology.

Potential areas of collaboration

- Work with IHLs to support shipowners and wind-propulsion system manufacturers to use maritime AI and digitalisation to optimise the technology .
- Work wind propulsion system manufacturers to explore pilot test-bedding on selected Green and Digital Shipping Corridors (GDSCs) to verify emission savings



International Collaborations



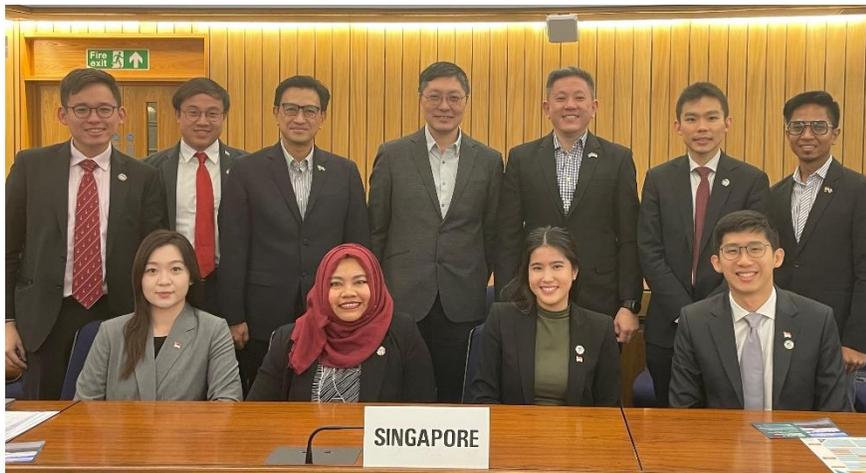
Singapore recognises the importance of international collaboration to drive the clean energy transition

- The energy transition will require strong cooperation amongst various stakeholders, and consensus-building on areas such as zero and near-zero technologies, safety and handling standards, financing etc.
- To facilitate this, MPA has been working through (i) **IMO**; (ii) **Green and Digital Shipping Corridors (GDSCs)**; (iii) **various multilateral and plurilateral partnerships**; and (iv) **organising global events**, to promote thought-leadership and encourage value chain collaboration



Singapore acts as a bridge builder, and actively contributes to discussions at IMO

- MPA represents Singapore at the IMO negotiations, and participates as the Vice-Chair of the Marine Environment Protection Committee (MEPC)
- Contributed to the Revised IMO GHG Reduction Strategy adopted in Jul 2023, and are part of the discussions on the basket of candidate mid-term measures and lifecycle GHG intensity of marine fuels (LCA) framework
- Singapore has also been sharing the learning points from our methanol and ammonia related trials with other member States at the IMO



MPA is working with our corridor partners on a wide-range of areas to decarbonise the shipping sector

Port of Rotterdam



Ports of LA and LB



Tianjin



Japan



Australia



Silk Alliance



Apart from corridors, MPA also works through other multilateral platforms and with international organisations to advance our energy transition interests

MOU with IEA



- MPA and IEA signed an MOU in April 2024 to strengthen their partnership and accelerate efforts in maritime decarbonisation
- Collaboration focuses on:
 - Advancing development and transition to zero and near-zero emission fuels, technologies that aid maritime decarbonisation
 - Exchanging best practices across the maritime and energy sectors through capacity-building training programs
 - Leveraging networks and expertise

C40 Green Ports Forum



- The inaugural Green Ports Forum held in 2023 was co-hosted MPA and C40 Cities
 - Discussed the contribution of green ports to emission reductions
- MPA is currently co-chairing the Green Shipping Corridor Workgroup alongside Port of Oslo
- At the C40 Transpacific Workshop in Shanghai on 17 June 2024, MPA delivered a presentation on Singapore's Energy Transition Plan to Decarbonise International Shipping



Apart from corridors, MPA also works through other multilateral platforms and with international organisations to advance our energy transition interests

NextGEN



- NextGEN, a collaboration between IMO and MPA, aims to establish a global ecosystem for decarbonisation initiatives in maritime transport
 - The website presently lists more than 400 decarbonisation projects and comprises over 900 stakeholders worldwide
- NextGEN Connect is an initiative by the IMO, MPA and Norwegian Ministry of Climate and the Environment, to drive inclusive climate action through: (i) developing a fuel supply corridor and (ii) training and upskilling seafarers and port workers in the handling of new fuels

Zero-Emission Shipping Mission



- Singapore, represented by MPA, is a Core Member of the ZESM
- The coalition, led by Denmark, Norway and the USA, aims to develop, test and commercialise maritime and energy technology and prepare the market for zero-emission vessels
- The first in-person Zero-Emission Shipping Mission Summit held on the sidelines of the Singapore Maritime Week in April 2023 where the Mission's strengthened 2030 goals were announced



MPA has been organising Singapore Maritime Week annually since 2006, with a strengthened focus on decarbonisation and sustainability in recent years

- SMW 2024 featured 50+ events focused on four main pillars: Decarbonisation, Digitalisation, Services, and Talent development
- MPA signed 30+ partnerships in areas such as training and cybersecurity, involving international organisations, governments, classification societies, tech companies, and trade associations
- At the Accelerating Digitalisation and Decarbonisation conference, the Decarbonisation conference saw more than 800 participants and focused on (i) how value-chain stakeholders can work together to produce, transport, and bunker net-zero fuels safely, (ii) explore promising digital and data technology and solutions to decarbonise the maritime industry, and (iii) seed opportunities for collaboration on pilots and trials
- MPA also held the inaugural GDSC Symposium, which featured GDSC partners from Australia, Tianjin, Ports of Los Angeles, Long Beach and Rotterdam and Japan.



MPA leads Sea Transport programming at the Singapore Pavilion at COP/CMP/CMA under the UNFCCC

- MPA has been organising a maritime program at the Singapore Pavilion on Transport Day for the past two years
 - At COP28, MPA held the Voyage to Net-Zero Forum attended by over 260 delegates. The Forum was a useful platform to promote thought leadership and strengthen global sustainability partnerships
 - At COP27, MPA presented its Maritime Singapore Decarbonisation Initiatives during the Maritime segment, before concluding with a Q&A session that involved an international audience
 - In addition, MPA, together with PSA, provided content for the physical and virtual exhibit panels to such as Tuas Port and its efforts in the Decarbonisation of its domestic harbourcraft



Maritime Singapore Green Initiative (MSGI)



MARITIME SINGAPORE GREEN INITIATIVE

\$50 million commitment



Green Ship Programme

- Initial Registration Fee and Annual Tonnage Tax Discounts for **Singapore-flagged vessels** that are:
 - Energy efficient
 - Equipped with zero-emission/zero-carbon/low-carbon technologies
- Port Dues discounts for **ocean-going vessels calling at the Port of Singapore** that use zero-emission/zero-carbon/low-carbon fuels in port



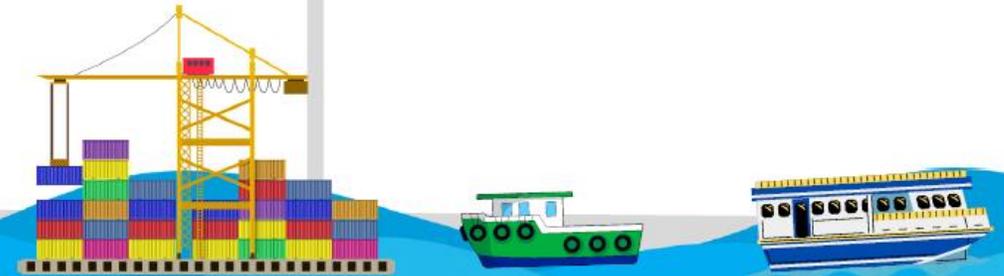
Green Port Infrastructure Programme

- Funding for projects and studies related to the **decarbonisation** of the Port of Singapore



Green Craft Programme

- Port dues discounts for **harbour craft** that use zero-emission/zero-carbon/low-carbon fuels or technologies



Green Energy and Technology Programme

- Funding to support the development, uptake and commercialisation of **Technology Readiness Level (TRL) technologies**



Green Awareness Programme

- Funding to **develop industry capabilities** in carbon accounting management





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Thank you!

