



Making a Difference in Sustainable Maritime Energy – Centre Update

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Maritime Energy & Sustainable Development Centre of Excellence

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Vision

A leading global *translational* research centre in maritime energy and sustainable development

Mission

- To advance, develop and apply research aimed at improving efficiency of current maritime energy systems while maximizing the synergies of alternative energy sources
- To minimize impact of maritime operations to the environment and to diversify energy sources towards sustainability
- To enable knowledge creation and translation of maritime technology by engaging global standard-setting authorities, government agencies, research institutions and industries
- To foster a multidisciplinary and collaborative culture for researchers in applied maritime energy & operation to interact, learn, and promote new energy, emission and operation solutions for the future industry and Singapore

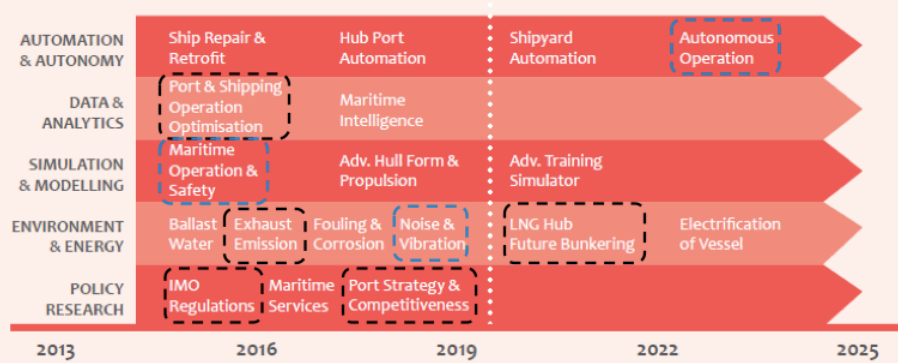
Supported by



Alignment with Singapore Maritime R&D Roadmap

SMI Maritime R&D Roadmap 2025

Maritime R&D Roadmap



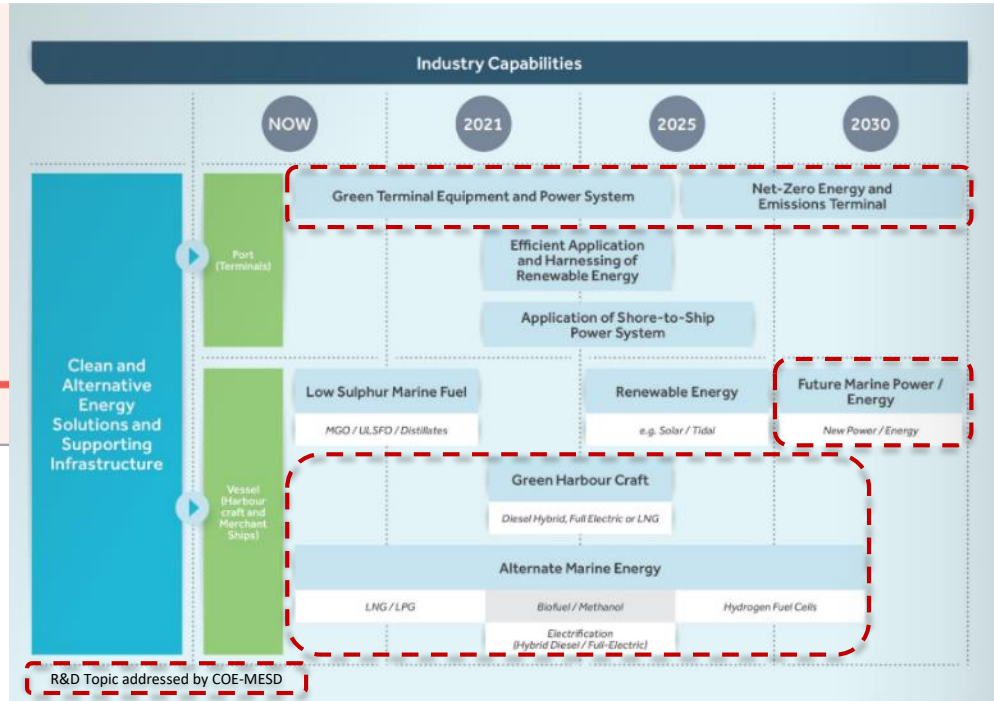
R&D Topic addressed by COE-MESD

Related R&D Topic addressed by COE-MESD

Source: SMI

SMI Maritime R&D Roadmap 2030

RESEARCH THRUST 5



R&D Topic addressed by COE-MESD

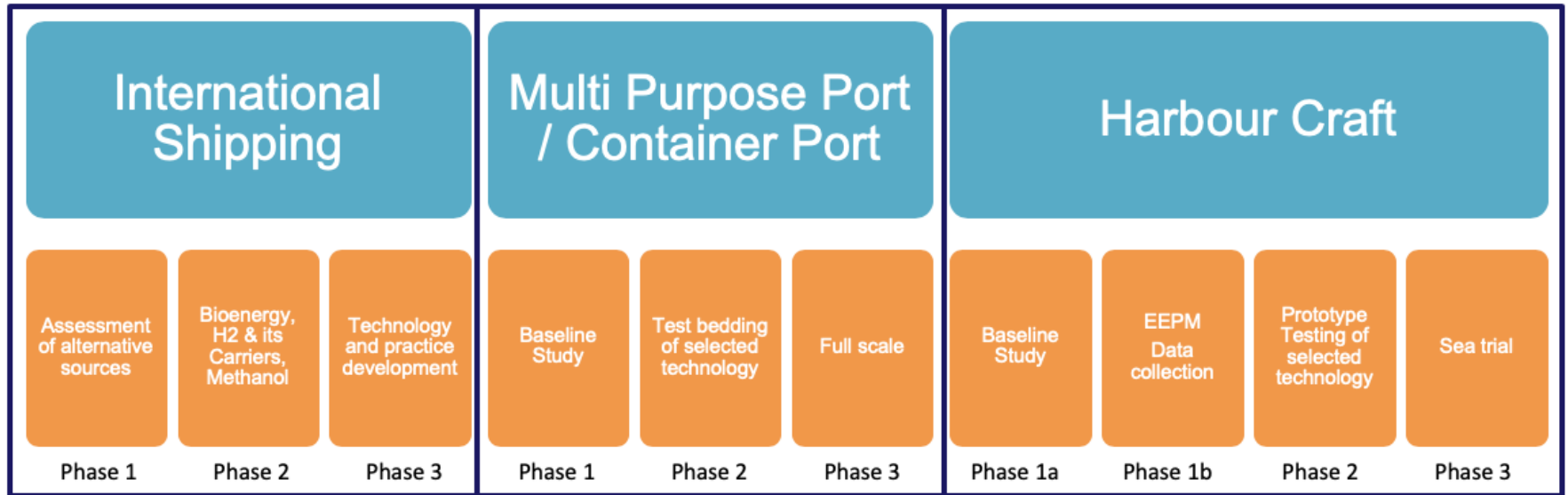
(Top) Launched in SMI Forum 2013

(Right) Launched in SMTC 2019
Supports the Sea Transport Industry Transformation Map (ITM)



What have we been working on?

Alternative Sources of Energy



Approach | International Shipping

Year 2018-19

Assessment of Alt Energy Sources for Maritime

Phase 1

Year 2020

In-depth study to enable the actual application of potential Alt

Phase 2

Planned

- Pilot Trial of Alt Energy
- Technology & practice development

Phase 3

Bioenergy

H2 & its Carriers

Methanol

Phase 2 :
Identified Fuel Groups:

LNG



Biodiesel
1st and 2nd gen



Methanol
and Bio-methanol



Methanol
and Bio-methanol



Bio-LNG



Biodiesel
(3rd gen)

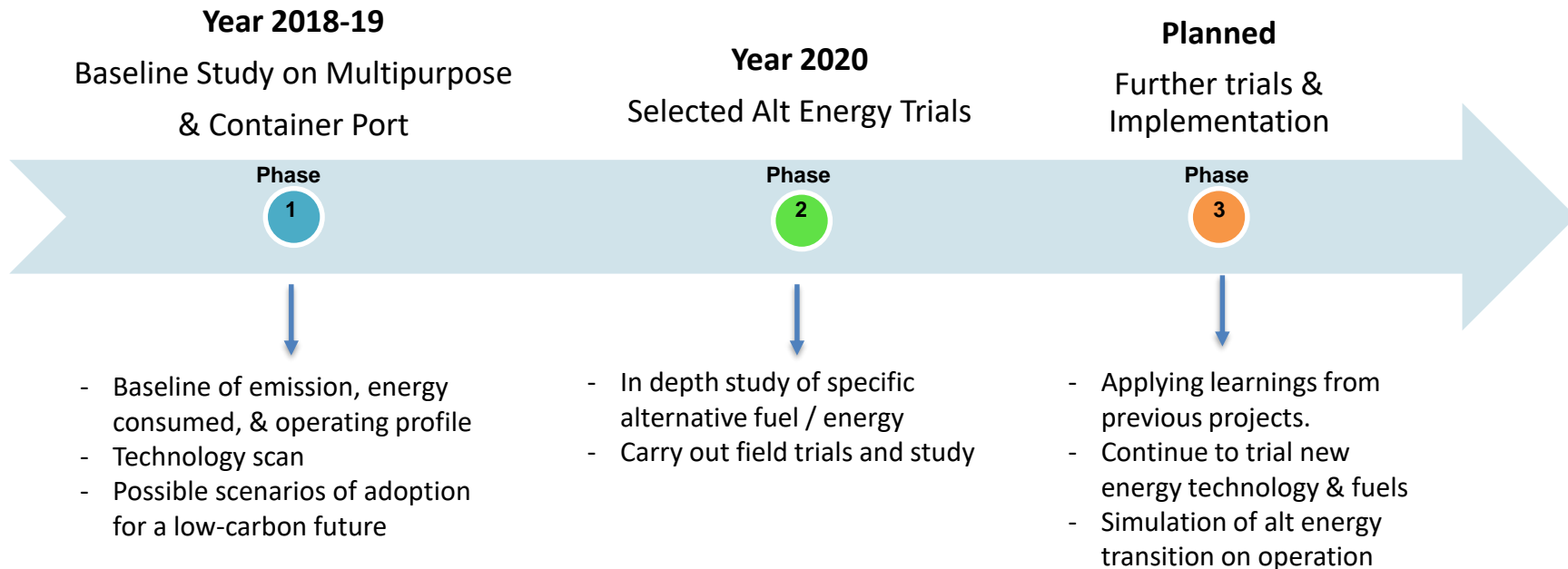


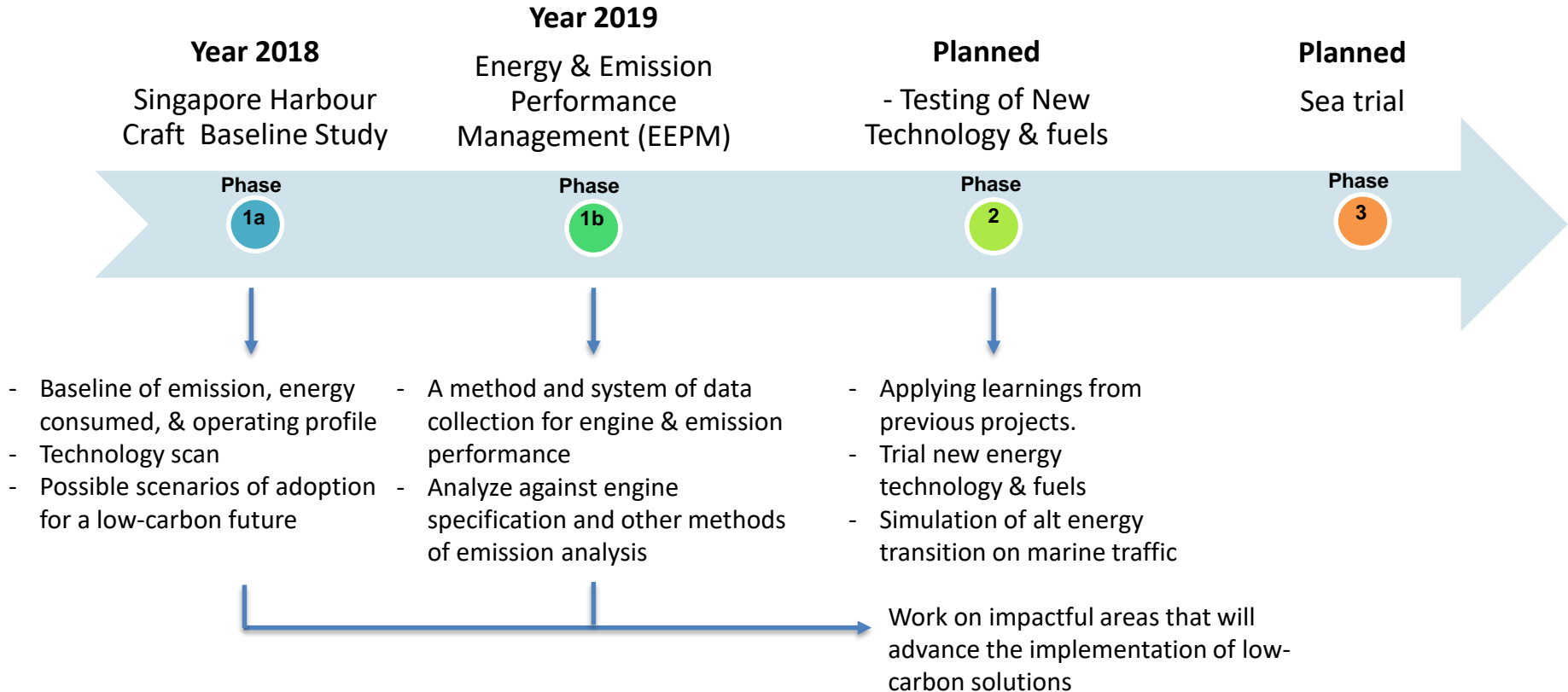
H₂ & its Carriers
(fossil-based and renewable)



Short- and medium- term
Now-2023 and 2023-2030

Long-term
2030 onwards





Alternative Energy

1. Study of potential alternative sources of energy for Shipping Industry
2. Study of potential alternative sources of energy for Next Generation Multi-Purpose Port Operation
3. Study of potential alternative sources of energy for Singapore Harbour Craft Industry
4. Project Hafnium: Hydrogen as a source of energy for OSV
5. Methanol as Marine Fuel for Singapore Harbour Craft
6. Study of potential alternative sources of energy for Next Generation Prime Movers
7. Energy & Emission Performance Measurement for SG Harbour Craft
8. Development of Sustainable Biofuel Pathway as Low-carbon Energy Sources Alternative to Conventional Fuels for Maritime Industry
9. Biofuel Compatibility Study for Singapore Harbour Craft
10. Ammonia as The Marine Fuel in Singapore – Supply Chain, Bunker Safety, and Potential Issues

Collaborators



Harbour Craft Owners

Emission Management

1. Support commercialisation of Novel Scrubber
2. Establishment of Atmospheric Emission Inventory for Container Port
3. Novel Approach of Selective Catalytic Reduction for Maritime Application

Sustainable Maritime Operation

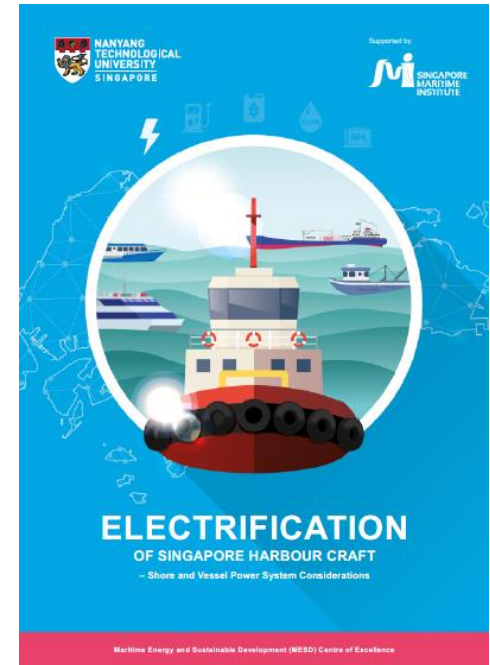
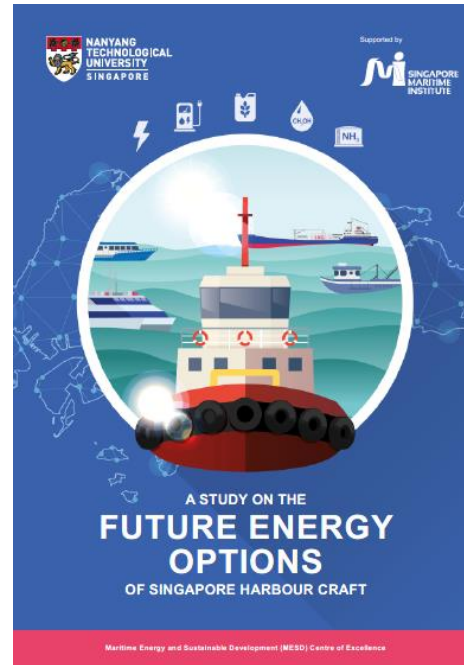
1. GHG Emissions from International Shipping: Strategies and Impacts
2. Case study on the benefits of TR48: 2015 Bunker Mass Flow Metering for bunkering industry in Singapore

Collaborators



Report “Alternative Fuels for International Shipping” was launched at SMI Webinar in **Apr 2020**

Two Reports will be launched today after the MESD Webinar





Moving Forward

What Have We Learnt ?

1. Technical & Operational measures plus LNG will not meet IMO 2050 goal. The maritime sector needs alternative fuel & market-based measures.
2. The crucial factors of alternative fuel.

Crucial Factors

1. GHG emission reduction potential (LCA)
 2. Technology readiness
 3. Availability of fuel / energy
 - Supporting Infrastructure
 - Supply Chain
 - Competing usage from other sectors
 4. Energy Density
 5. Safety
 6. Crew training & competence
 7. Cost
3. The applicability & type of alternative fuel/energy varies for users in different sectors and regions. There is no one solution that fits all.
 4. There is a need to study the supply chain of the alternative fuel that can span multiple industries and across the world.
 5. Adoption requires changes to supporting infrastructures and end-user's assets. These require money and time. It will be a transition over time.
 6. The industry will need to change the current mode of operation, which means that people will also need to adapt and change. Thus, the ability to transit from current mode of operation is also crucial.
 7. There is a need to focus on the areas and domain that matter most given limited resources.

Phase 1 **Completed**

Baseline & In-depth Understanding of targeted application & Alternative fuel / energy.

- International Shipping
- Singapore Harbour Crafts
- Multipurpose Port
- Container Port
- OSV*
- Bunkering*

Phase 2

Further study into identified alternative fuel & key issues. Include trial, if appropriate.

Focus Areas:
Emission Management
Sustainable Maritime Ops

* External Projects, OSV- Offshore Vessel

1. What matters for Singapore & the maritime industry?

- a. Global Transshipment Hub
- b. Leading Int'l Maritime Centre
- c. Bunkering Hub

2. Enable energy transition

a. What can we do now for the incumbents?

- i. Availability of drop-in & short-term alternatives (E.g. Biofuels, Hybrid, etc.)

b. What can we do now to prepare for the future?

- i. Trials emerging & near-ready solutions to gain deeper knowledge of the challenges and ways to overcome
- ii. Understand the requirement (Safety & Ops) for future alternative fuel bunkering & charging
- iii. Support the development of new standards & future policies
- iv. Invest in promising alternative solutions (e.g. CCSU.)

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Thank you

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