



**NANYANG
TECHNOLOGICAL
UNIVERSITY**
SINGAPORE

Maritime Energy and Sustainable Development Centre of Excellence

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Maritime Activities in Singapore

Core Maritime Activities in Singapore:

- A. Terminals Operations– Cargo Handling
- B. Marine Operations and Services
- C. Marine & Offshore Engineering

- At any one time, there are about 1,000 vessels in the Singapore port.
- Every 2-3 minutes, a ship arrives or leaves Singapore.

Essential Marine Services

Bunkering , Pilotage, Towage,
Mooring, Fresh Water Supply,
Crew Change, Ship Supplies

Maritime Activities within Singapore Port Limits

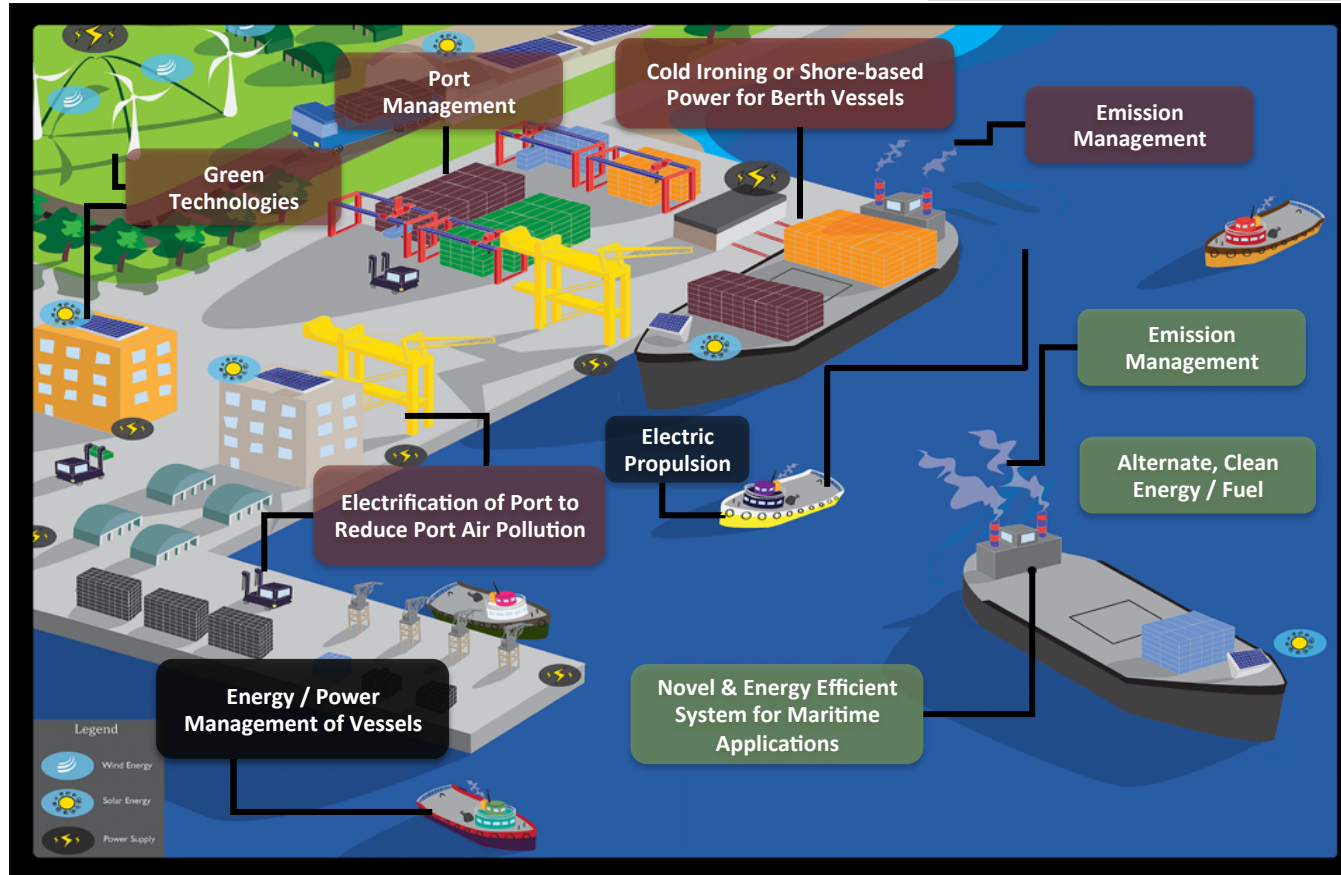
1. Tuas Mega Port
2. Container Terminals
3. Multi-purpose Terminals
4. Shipbuilding, Repairing, Conversion
5. Petrochemical Terminals
6. LNG Terminal
7. Passenger Terminals
8. Anchorage areas for essential Marine Services like: Bunkering, Pilotage, Towage, Fresh Water Supply, Crew Change, Ship Supplies, Waste Disposal, Minor Repairing, Surveying

*** Other Shore-based Maritime Services not labelled in the map**
Ship Registry, Ship Management, Shipping Finance, Maritime Legal & Arbitration, Marine Insurance, Shipbroking & etc



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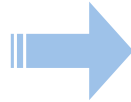
Maritime Energy & Sustainability | Overview



Options for Port Emission Control

Moving into future, Singapore is promoting cleaner power for marine vessels & higher level of electrification for port-side cargo handling.

MESD CoE will support and assist in the planning, assessment and implementation of emerging technologies and measures



Equipment measures

- Engine Technologies
- After-Treatment Technologies
 - SCR
 - Exhaust Gas Scrubbers
- Barge-based systems

Energy measures

- | | |
|--------------------------|--------------------------|
| - Alternate Fuels System | - Alternate Power System |
| - Low Sulfur Fuels | - Hybrid / Full Electric |
| - LNG | - On-shore power supply |
| - Emulsified fuel | - Barge power supply |
| - Methanol | - Solar Power |
| - Biofuels | |

Operational measures

- Harbour Crafts
- Port Support Vessels

*“ A **Centre of Excellence** refers to **a team**, a shared facility or an entity that provides leadership, best practices, research, support and/or training for a focus area “*

Vision

A leading global applied research centre in maritime energy and sustainable development

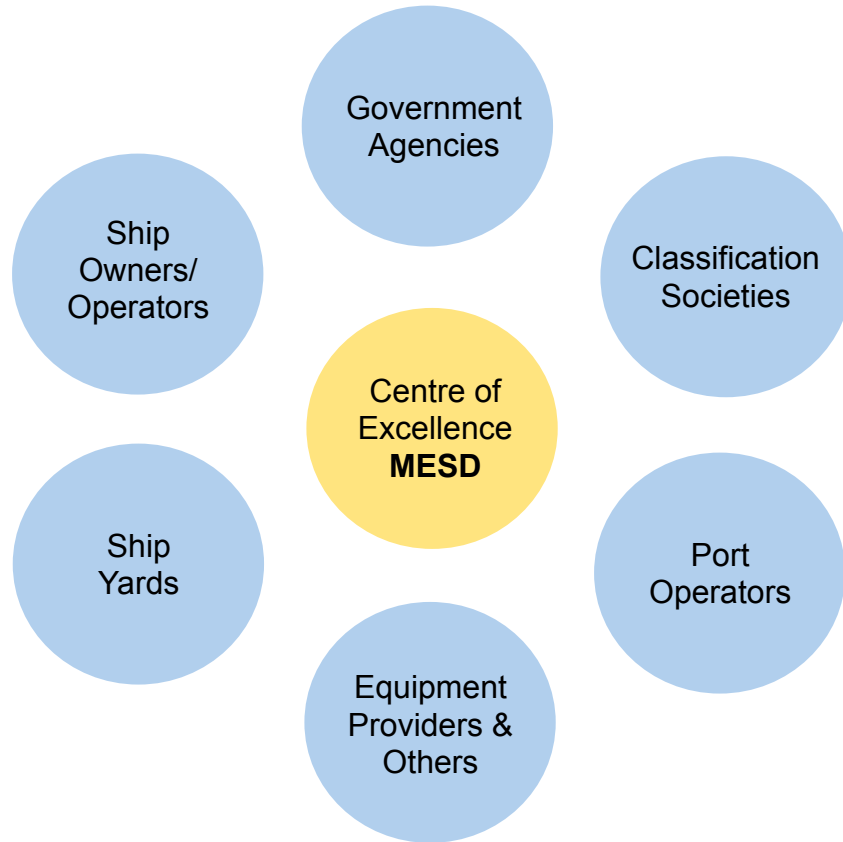
Supported by



Mission

- To advance 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 environment for researchers in maritime energy & operation to interact, learn, and promote new energy solutions for the future

MESD | Centre of Excellence | Holistic Approach



Maritime R&D as a Career Option

- Funding support to sustain a core R&D team
- Exchange program with collaborating partners

Manpower Development

- Internship for undergraduates and polytechnic students
- Complementing existing maritime related courses

Research Excellence

- Focus R&D Areas
- Visiting Experts from Industry Partners
- Thematic R&D program
- Exchange program with collaborating partners
- Catalyzing Ideas

Internship for Undergraduates, Polytechnic & ITE Students

Engineering Undergraduates at NTU and other IHLs

- Depending on level of activities, slots will be open for undergraduates & other IHLs students for internship

Polytechnic & ITE Students

- Targeting 2-3 interns to work along side undergrads interns on MESD focus areas topics

Complementing existing maritime related courses

Professional Courses, Diploma, Degree & Postgraduate Programme

- A scan of existing maritime training programs will be carried out. (E.g. List of training courses eligible for training grant under Maritime Cluster Fund (MCF). The team will explore if METB facility and content can be added as part of the training curriculum.

Research Excellence | MESD R&D Focus Areas

Green Ports and Shipping

(Including infrastructure, processes and harbourcrafts)

Novel & Energy Efficient System

Energy Management Tools

Waste Energy Recovery System

Energy
Management

Alternate, Clean Energy / Fuel

Emission Control & Monitoring

Emission
Management

Sustainable Maritime Operations

Practicality of novel technologies, cost-benefit analysis, socio-economic assessment, policy study and recommendation, technology transfer and training

Alignment to Singapore Strategic Maritime Needs

Singapore maritime needs

Port Competitiveness
Maritime & Crew Safety

Logistics & Supply Chain
Maritime Environment

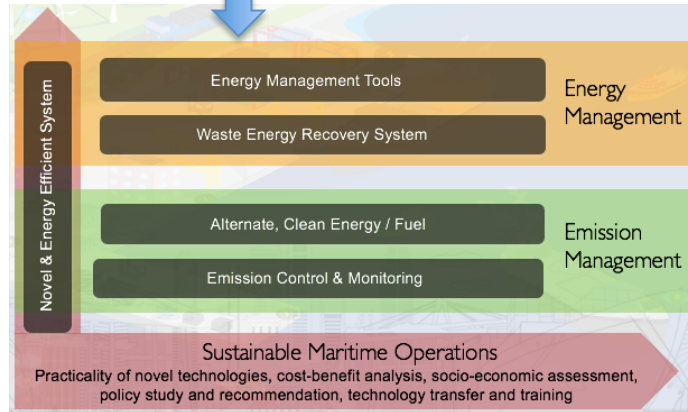


Invest in Core Maritime R&D Capabilities | High Level Focus Areas

Energy & Environment

Operations & Logistics

Safety & Security



Centre R&D Focus Areas

Translating R&D Investment to meet S'pore maritime needs

1. Consultation with End Users to identify / confirm challenges
2. Study/analyze challenges and propose solutions / ideas. Conduct feasibility study if needed.
3. Leverage on testbeds and living laboratories at each stage
4. Identify value capture for Singapore and form project team (including industrial partners)
5. Execute and coordinate projects (program) along with eventual technology adopters and executing entities

Challenges | **Port Sustainability** | **Environment Protection & Air Emissions** | **Maritime Energy**

Feasibility Study | Ideas / Proposed Solutions

Govt Agencies/ Regulators

Equipment Providers & Others

Classification Societies

IHL's Faculty & Researchers

Startups | **SMEs** | **LLEs** | **MNCs**
Commercialising Party / Parties

End Users	Port Owners & Operators
Shipyards	Vessel Owners & Operators

TRL 1-2

TRL 3-7

TRL 8-9

TRL: Technology Readiness Level (1: Basic R&D -> 9: Ready Commercially)

MESD | Catalyzing Ideas



Image Source: www.hortmag.com

- New Ideas or initiatives will emerge through COE's course of work, internally and with partners.
- These “Seeds”, if properly managed and harvested, can be a source of new and innovative projects.
- MESD COE proposed to support determined number of ideation projects annually.
- Awardee has three months to proof feasibility of ideas.
- Upon successful validation, project will be further developed for competitive or collaborative projects.
- The idea is to let the seed projects start fast (and fail fast)
- Helps to nurture an innovative culture within COE where ideas are supported and “failure” is ok.

Leveraging on existing Maritime Facilities

Maritime Energy Test Bed



Thank you
