

Overview of Singapore Harbour Craft's Profile

MPA-SMI Joint Workshop on Harbour Craft Electrification

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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.

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• Every 2-3 minutes, a ship arrives or leaves Singapore.

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Maritime activities in Singapore

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Essential Marine Services

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

Singapore

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
- 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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Types of Harbour Craft

- There are ~2,300 harbour crafts.
- Around 30% are non propelled and 70% propelled
- Excluding 'Others*' category, Lighter, Tugboat, Tanker and Passenger form the main profile of the local harbour craft community



Tankers [SB]



Lighter [SC]



Tug boat [ST]

















*SR & others. Include barges of all types such as crane, dredgers, hoppers, small research and multipurpose vessels

Source: MPA, 2017



Pilot boat [SP]

Age & Gross Tonnage of Harbour Craft

- More than half of harbour craft is more than 10yrs
- Age distribution among the HC type is relatively even from 10 yrs onward with SP, SB & ST having less vessels in 0-4 yrs band



- Harbour Craft's Gross Tonnage (GT) is evenly distributed between "10-49", "50-499" & "500 & above"
- Electrification with battery included need to strike a balance between range of operation vs weight of battery



Source: MPA, 2017

Power breakdown of Harbour Crafts

Breakdown of Engine Shaft Power (kW) across each harbour craft segment for Year 2017



Operational Profiles

Туре	Purpose	Working duration (per day)	Typical Speed* (knots)	Operating Mode*
SB	Bunker Tanker	3-4 hrs	5-6	Idle & Standby: 10-15%, Transit: 20-25% , Work: 65%
SP (<12)	Passenger	7-8 hrs	12	Idle & Standby: 70%, Work: 30%
SP (>12)	Passenger	5 hrs	12	Idle & Standby: 15%, Maneuvering: 15%, Work: 70%
ST	Tugboat	As required	5-6	Idle: 60%, Standby: 10%, Transit: 15% , Work: 15%

Source: Compiled by MESD

*On-going work

Bunker vessel has more operating needs

RORO operation is scheduled and typically has fix routes

Passenger vessel operates at higher speed and has high variability in work (30-70%)

Tugboat operates on idle & standby mode most of the time

Anchorage and Public Landing Places



It is important to consider the operating zone in the study of maritime energy as it affects the following parameters.

- Distance travelled
- Operating profiles
- Refueling / Recharging
- Speed of travel

Towage activities are concentrated within the Western Part of Singapore, where the shipyards and port terminals are located. Tugs are usually moored near their work location.

Bunkering activities are concentrated around designated anchorages and terminals.

Most personal transport start from public landing places within each sector.

Refueling / Charging Infrastructure



Electric Charging Infrastructure

Key differences in components:

- Increase in substation capacity for shore to ship bunkering (cold ironing)
- Requires batteries storage capacity for ship to ship bunkering
- · Cable with connectors for receiving.

Alternative Energy: Grid Electricity / Renewable Electricity



Consideration of electrification for harbour craft



Source: MESD, NTU

Constraints of harbour crafts





Retrofit vs New Build





Limited space in engine room

Survey & Interviews

- 9 HC operators
- ~10% of SG HC population size*

Key takeaways

- Preferred choice of alternative energy solutions:
 - 1. LNG
 - 2. Full electric
 - 3. Plug-in hybrid
 - 4. Biodiesel
 - 5. Alcohols (MeOH)
- Key barriers to adoption are:
 - 1. Capital expenditure
 - 2. Supporting infrastructure
 - 3. Availability of fuels
 - 4. Operating expenditure
 - 5. Ease of implementation and operation

HC companies surveyed Fleet Composition



* 2017 data Source: Compiled by MESD

Knowledge sharing

- There are many options available in the market for fuel saving and reduction of GHG emissions. (e.g. 19 Technical & Operational measures & over 10 alternative fuels & energy)
- Owners may be confused or overwhelmed by the highly diversified information and thus hard for owners to build up confidence to strategize their future development.
- There is need for a collective, reliable source of information to guide and streamline the decision making for harbour craft owners

Feasibility study & directives on alternative energy

- Insufficient experience or lessons learnt. Experience from other industry (land transportation) is not fully applicable, leading to uncertainties.
- Concerns of loss of cargo space and vessel endurance

Lowering the cost of technology through R&D

Necessary infrastructure and availability of fuel/energy

Thank you

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For more information, please visit MESD website http://coe.ntu.edu.sg/MESD_CoE