



Harbour Craft Safety Forum at Singapore Safety@Sea Week 2025

Advancing Sustainability in Maritime Energy
Development Through Skills Development

Institute of Technical Education (ITE) / College Central
Marine Offshore Engineering

Institute of Technical Education

Key Milestones in ITE's Transformation

The Institute of Technical Education (ITE) was established as a post-secondary institution, under the Ministry of Education (MOE), to take over the functions of the Vocational and Industrial Training Board (VITB) in April 1992.

Since then, ITE has transformed itself to become the principal provider of Career and Technical Education in Singapore.

- First Education Institution to win the Singapore Quality Award (SQA) in 2005 and the SQA (with Special Commendation) (SQA SC) in 2011.
- In 2017, we celebrated our 25-year journey of 'Inspiration, Transformation and Excellence' and introduced Work-Study Diploma (formerly known as Work-Learn Technical Diploma) as another progression pathway for our graduates.
- In 2018, we became one of only two Public Agencies to receive the SQA SC for a second time.



Institute of Technical Education

Elevating Professional & Technical Education in Singapore



Students

Elevate their work-readiness, future-preparedness, and social mobility

ITE Elevate aims to raise the outcome quality for all our stakeholders, to enable greater success and create brighter future, at work and in life.



Workers

Elevate their skills relevance, employability resilience and career mobility



Companies

Elevate transformation, productivity and internationalisation



Organisation

Elevate capability, culture, innovation and impact





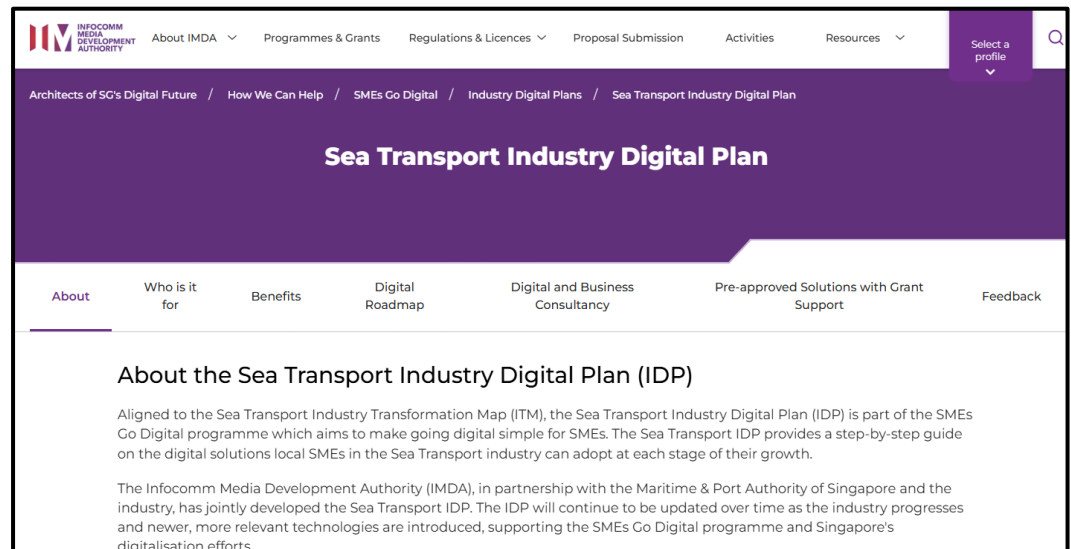
Maritime Singapore Green Initiative

The Maritime Singapore Green Initiative (MSGI) seeks to reduce the environmental impact of shipping and related activities and to promote clean and green shipping in Singapore. In 2011, the Maritime and Port Authority of Singapore (MPA) pledged to invest up to S\$100 million over 5 years in the MSGI. Enhancements to the MSGI were made in 2013, 2019 and 2022, to further encourage companies to adopt environmentally friendly shipping practices.

In 2024, MPA updated various green initiatives and incentives under the MSGI to encourage early adoption of zero and near-zero emission technologies and fuels. MPA will commit another S\$50 million to support the implementation of the refreshed MSGI which comprises of five programmes:

- I. Green Ship Programme
- II. Green Port Infrastructure Programme
- III. Green Craft Programme
- IV. Green Energy and Technology Programme
- V. Green Awareness Programme

These are voluntary programmes designed to recognise and provide incentives to companies that adopt clean and green shipping practices and port operations. The initiative underscores Singapore's commitment as a responsible flag and port state to clean and green shipping.



Institute of Technical Education

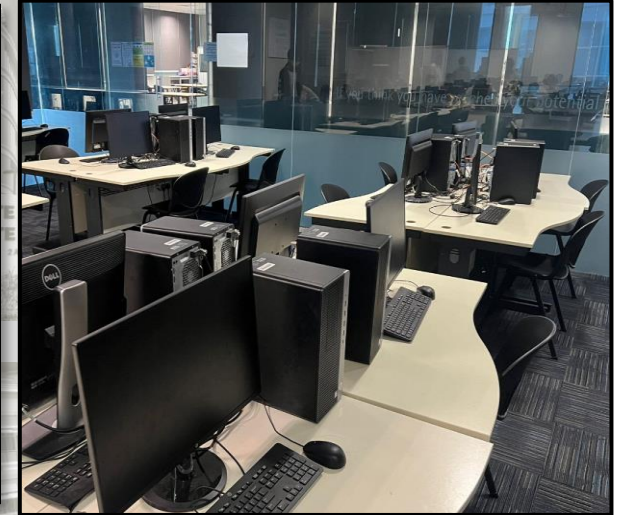
ITE College Central Marine Offshore Engineering

- *Higher Nitec* in Marine Engineering
- *Higher Nitec* in Marine Offshore Technology
- *Higher Nitec* in Offshore & Marine Engineering
- Work Study Diploma (WSDip) in Marine Offshore Engineering

Engine Simulation Room



Engineering Design Hub



Maritime Training Hub



Fabrication Workshop



ITE – Seatrium Digital Learning Lab

The Maritime and Port Authority of Singapore (MPA) is moving decisively to develop various net-zero fuel pathways in the Port of Singapore. MPA targets for Singapore's domestic harbour craft sector to achieve net-zero emissions by 2050, and will require all new harbour craft operating in our port waters to be fully electric, be capable of using B100 biofuels, or be compatible with net-zero fuels from 2030. As a major bunkering hub, Singapore is also building up ammonia, hydrogen and methanol value-chains to safely offer a range of fuel solutions for the international shipping industry.

Develop comprehensive training requirements covering various aspects such as battery systems, electrical safety, maintenance, firefighting, and regulatory compliance for training for personnel to handle battery-powered harbour craft.

Challenges

- (a) Diverse Types of Vessels.
- (b) Long vessel lifetimes (several decades) compared to automobiles. Hence, the number of retrofits to existing vessels is higher.
- (c) Different installation and operational conditions.
- (d) Need for advanced technologies and large investments on onshore/offshore power supply and charging infrastructure.

Requires collaboration across different disciplines, industrial sectors, and geographic regions to be more effective overall.

- (i) Policy and regulations.
- (ii) Investment benefits.
- (iii) Operational benefits.
- (iv) Safety.

Training Requirements

01

(a) Micro-Learning Module Maritime Decarbonisation – Sustainable Energies for the Maritime Industry

E-Harbour Craft : The Green Wave of Maritime Technology



gnowbe

https://eventsportal.ite.edu.sg/event/sessions?id=Micro_Learning_Course_-_E-Harbour_Craft_The_Green_Wave_of_Maritime_Technology2114724112

E-Harbour Craft : The Green Wave of Maritime Technology

MINUTES

32

SESSIONS

4

ACTIONS

25

The Micro-Learning Courses (MLC) for the E-Harbour Craft: The Green Wave of Maritime Technology equips participants with the essential knowledge and skills to navigate the transition towards electric propulsion in harbour craft operations.

This course covers the fundamentals of electric marine systems, including design principles, components, and operation. Participants will gain insights into regulatory considerations, safety protocols, and maintenance procedures specific to electric harbour craft.

By the end of this MLC, you will be well-positioned to contribute to the sustainable development of the maritime industry.

We would like to thank Dr Imran Halimi Bin Ibrahim (MESD CoE) NTU and Mr Tommy Phun Founder of Phyxis, for permitting us to use his presentation to produce this MLC.



Training Requirements

01

(a) Micro-Learning Module

Maritime Decarbonisation – Sustainable Energies for the Maritime Industry

S/N	List of Sessions	Number of Actions
1.	Learning Objective and Understanding the Impact of Greenhouse Gases	5
2.	The E-Harbour Craft	9
3.	Primary Systems on E-Harbour Craft	6
4.	Safety Management for E-Harbour Craft	5

Training Requirements

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T1 GLOBAL CLIMATE CRISIS

T2 Different Power Configurations of Harbour Craft

- Diesel-mechanical propulsion
- Diesel-electric propulsion
- Hybrid propulsion
- Hybrid
- Full-electric vessel

T3 Electrical Systems and Key Components

- Electrical Propulsion
- Shipboard Electrical Distribution
- Electrical Energy Storage Systems

T4 Safety Management with Electrical Systems

- Ground switching when charging from shore
- Use of lithium batteries and battery management system
- Emergency power supply
- Maintenance



Training Requirements



01

(b) Certificate of Competency (CoC)
Training for Maritime Personnel to handle Battery-Powered Harbour

Skills Framework Sector	Marine and Offshore
Targeted Job Roles	Technician
Key Tasks	Monitor and adjust machinery parameters in marine equipment and systems to acceptable operating ranges.
Technical Skills & Competencies	Technology Application – Level 2

Skills Framework Sector	Marine and Offshore
Targeted Job Roles	Supervisor, Harbour Craft Master, Officer, Engineer
Key Tasks	Assemble ships, rigs, and marine equipment.
Technical Skills & Competencies	Technology Application – Level 3

Training Requirements

01

(b) Certificate of Competency (CoC) Training for Maritime Personnel to handle Battery-Powered Harbour

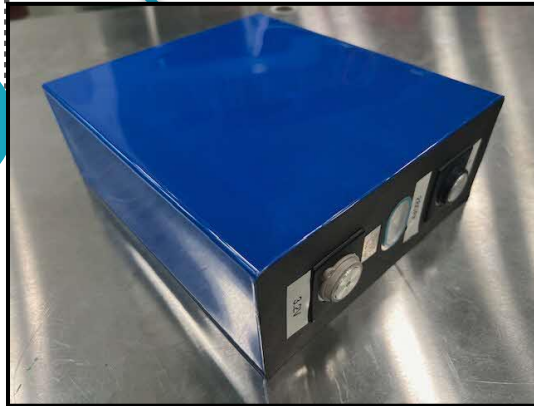
C1 Familiarise with the working principles of batteries and the physical and chemical properties of battery cell electrolytes.

C2 Perform safe operation of batteries and battery management systems, as well as mechanical and electrical equipment, including high voltage installation.

C3 Conduct a risk assessment on battery operation.

C4 Respond to emergencies onboard battery-powered harbour craft.

C5 Practical Training.



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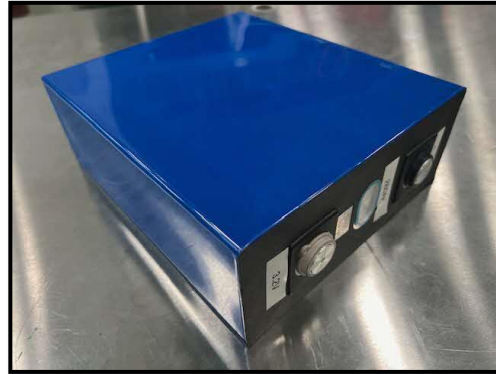
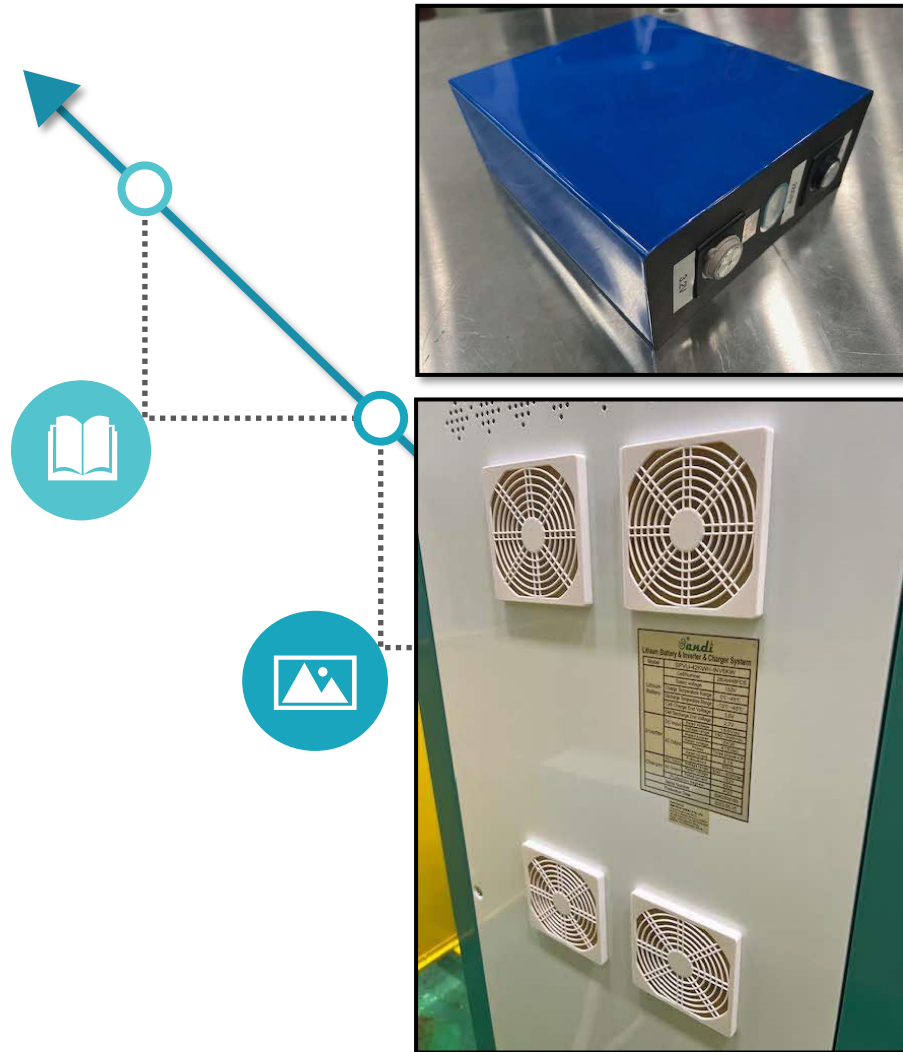
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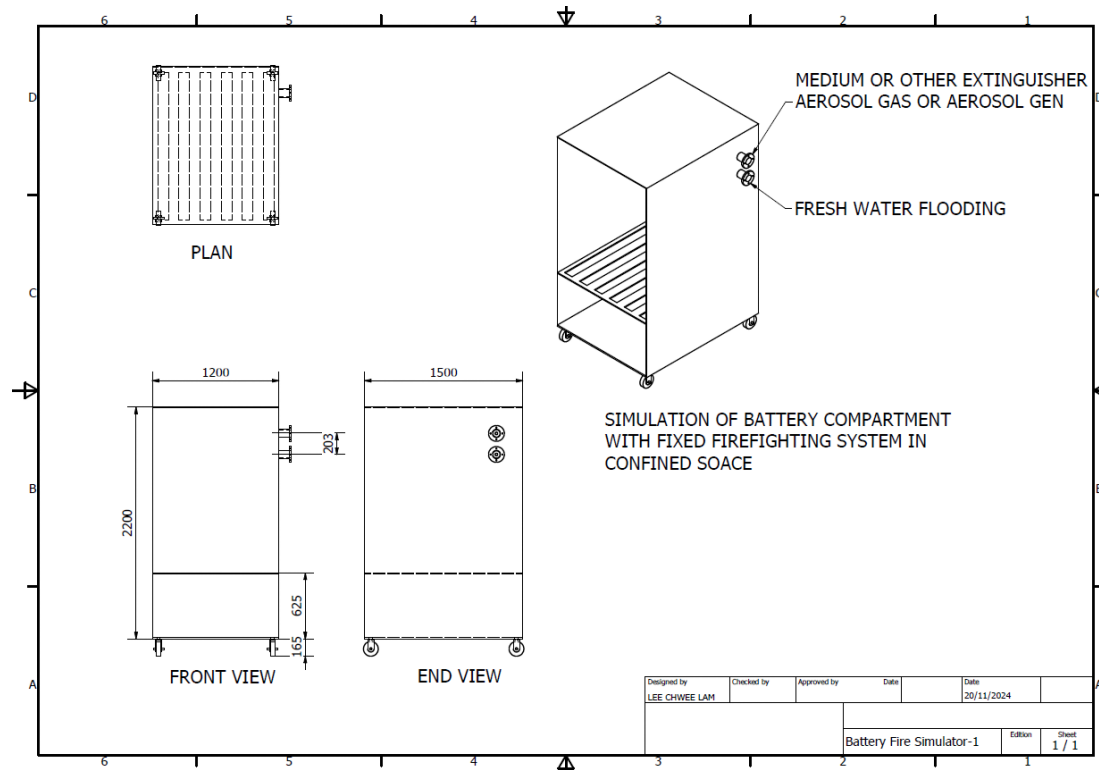
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Safety requirements in six aspects: (i) emergency management, (ii) continuous improvement, (iii) in-house competence, (iv) continuous monitoring, (v) quality control and (vi) information sharing.

Competency Training on Emergency Response

C4

Respond to emergencies
onboard battery-powered
harbour craft.

01

Target Job Role

For maritime personnel and current port-limit engine drivers, helmsmen, steering personnel, special limit deck, and engineer officers

- 1. Thermal Management (Liquid Cooled & Air Cooled)
- 2. Gas Detection & Ventilation
- 3. Battery Management System (Monitoring, Computation, Communication, and Protection)

- 1. Monitoring
 - Trigger point for thermal runaway $\approx 200^{\circ}\text{C}$
 - Spread of thermal runaway to adjacent battery cells

- 1. Risk Management
 - MES reporting procedures outlined in the port circular
 - Assembly & Evacuation
 - Last resort – fire suppression, preventing of battery reignition (trigger flooding of the battery compartment with seawater or saltwater)

Cause

Prevention

Negligent Charging /
Discharging

Include voltage upper and lower limits using BMS software and hardware sensing of each cell with direct trip line to DC breaker

High external
temperatures

Encase cell in cooling liquid to prevent heat from reaching the cell.

Ensure cooling water is flowing at all times and prevent external fire from reaching batteries.

External Short Circuit
/ High Current

Encase cell in cooling liquid to prevent heat from reaching the cell.

Crush proof cell casing passing UN38.3 transportation tests.

Mechanical Damage

SPBES PlanB uses 19mm of aluminum armor protecting cell edges.

Dendrite Formation

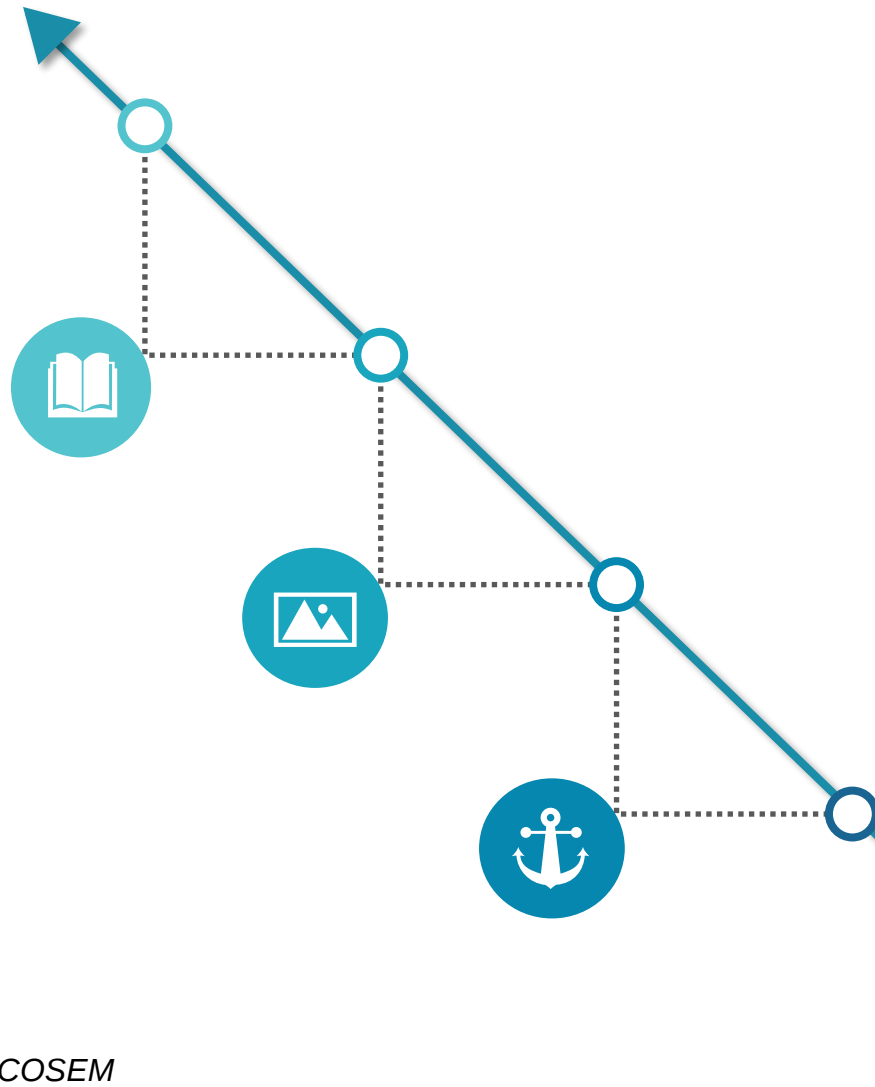
Encase cell in cooling liquid to prevent heat from reaching the cell. If an internal short occurs from dendrite or manufacturing defect – the liquid cooling is able to remove more heat than a runaway cell is able to produce. Required coolant flow between 0.5GPM and 2GPM for RMS C rates between <0.1 and 3C.



PREVENTION



Training Requirements



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THANK YOU