





# DELIVERING INNOVATIVE & SUSTAINABLE SOLUTIONS

BOOSTING INNOVATION DEVELOPMENT  
THROUGH RESEARCH & DEVELOPMENT,  
TECHNOLOGY COLLABORATIONS AND  
STRATEGIC INVESTMENTS TO DRIVE  
OFFSHORE, MARINE AND ENERGY  
DECARBONISATION

## Collaborations to explore viability of ammonia as a marine fuel to pave the way for emission-free shipping in the future

Leveraging our vast expertise and technological bench strength in the design and construction of marine vessels, as well as LMG Marin's cutting-edge design capabilities, we have designed an ammonia bunkering vessel and provided information for Hazard Identification Study. Together with our partners, Mitsui O.S.K Lines and ITOCHU Corporation, we have attained Approval in Principle from the American Bureau of Shipping for the innovative and sustainable concept design of an ammonia bunkering vessel.

## DELIVERING INNOVATIVE & SUSTAINABLE SOLUTIONS

Innovation is a strategic enabler at Sembcorp Marine which drives the Group's sustainability, corporate transformation and technological improvements.

The Group is focused on boosting its innovation capabilities through:

- Development of technologies and solutions that provide a differentiated edge;
- Strategic collaborations with government agencies, research institutions, classification societies and industry partners; and
- Strategic investments in intellectual property.

These efforts have enabled us to enrich our core engineering capabilities as well as develop novel and non-traditional technological solutions and designs.

To develop innovative and sustainable solutions that add value to our offshore, marine and energy industry customers, we align our research and development programmes with our five innovation focus areas. We also actively work with our business partners to develop our innovations from conception to implementation in our pursuit of new opportunities and sustainable objectives. Sharing the vision of creating a more sustainable planet for current and future generations, Sembcorp Marine actively champions decarbonisation in the maritime industry through collaborations with industry stakeholders and knowledge partners in the development of pioneering technologies in clean and renewable energy.

*"The world's energy transition is underway, and the marine industry is proactively driving towards a greener future. This exciting period of change also opens up new business possibilities and opportunities. Sembcorp Marine is now leveraging its engineering expertise, state-of-the-art facilities, green innovations and technology to create and deliver clean energy solutions for a more sustainable offshore and marine industry."*

- Mr Wong Weng Sun, President & CEO of Sembcorp Marine



# Our Engineering and Design Capabilities for Turnkey Projects

With close to 60 years of track record in the engineering design of different ship types, our engineering scope of work ranges from conceptualization of design, front-end engineering design (FEED), basic design, detailed engineering, construction engineering to final as-built.



The FEED phase is crucial in a turnkey engineering, procurement and construction (EPC) project's lifecycle. With superior design and engineering capabilities, we are able to offer innovative and sustainable design concepts, optimise the designs, develop cost-effective execution and supply chain solutions. During this early design phase, we work closely with our customers, design companies and marine classification societies to achieve design finalisation resulting in minimum changes during detailed engineering and construction which is the key to successful EPC projects.

Completed over **25** EPC projects in the last 15 years



Sleipnir Semi-submersible Crane Vessel



Johan Castberg FPSO



Noble Lloyd Noble Jack-up Rig



Helix Q7000 Well Intervention Semi-submersible Vessel



Pioneiro de Libra FPSO



Transocean 20k Drillship

## Dorado FPSO FEED awarded in 2021



Dorado Floating Production, Storage and Offloading (FPSO) is converted from a donor Suezmax vessel, Nordic Brasilia shuttle tanker. Features of the FPSO include:

- Production rate of 100,000 Barrels (bbl) per day
- Designed to accommodate 80 personnel on board
- Dis-connectable submerged turret production with buoy moored to the seabed
- Re-injection compressors, 3x13-megawatt gas turbine generators
- 12 cargo tanks with approximately 860,000 bbl storage capacity

## DELIVERING INNOVATIVE & SUSTAINABLE SOLUTIONS

### Contributing to Maritime Decarbonisation



#### World's First Liquid Hydrogen-powered Vessel

The MF HYDRA is a zero-emission vessel operated by Norled and is the world's first vessel to be powered by liquid hydrogen. A sustainable and innovative ferry designed by Sembcorp Marine's wholly-owned subsidiary, LMG Marin AS (LMG Marin), it has won the prestigious Ship of the Year Award presented by Skipsrevyen as well as the Best Medium Ro-Pax Award at the Work Boat World Awards 2021.



#### Collaborating on Maritime Decarbonisation

In April 2021, Sembcorp Marine has signed a Memorandum of Cooperation with the Maritime and Port Authority of Singapore and five other partners to set up the Global Centre for Maritime Decarbonisation (GCMD) in Singapore to drive decarbonisation in the maritime industry.

Together with other partners as founding members, we participated in a study initiated by GCMD to define safety and operational envelopes for an ammonia bunkering pilot in Singapore.



#### Exploring Hydrogen as a Marine Fuel

Sembcorp Marine advanced decarbonisation in the marine industry with the signing of a Memorandum of Understanding in April 2021 with Shell and Penguin International to jointly develop and pilot the use of hydrogen fuel cells for ships in Singapore - a first for the nation.

The collaboration will see Sembcorp Marine designing, fabricating and integrating a hydrogen fuel cell system onto a roll-on/roll-off vessel.



### World's Largest Zero-emission Ferry

In November 2021, Sembcorp Marine through LMG Marin has been awarded a contract for the design of a hybrid Ropax freight ferry.

The 484-feet-long ferry will be powered with a hybrid electric propulsion system which will be deployed to ply between the ports of Rodbhy and Puttgarden in Denmark and Germany.



### World's First Zero-emission Ammonia-Fuelled Tanker

In December 2021, LMG Marin secured a contract to design the world's first green ammonia-fuelled tanker, the MS Green Ammonia, for Grieg Edge.

The zero-emission vessel will transport and distribute green ammonia fuel from a production facility in Berlevag, Norway, to Svalbard, a Norwegian archipelago between mainland Norway and the North Pole from 2024, replacing coal-fired power.



### Developing Low-carbon Ocean Data Centre

In September 2021, Sembcorp Marine, Big Data Exchange and National University of Singapore signed a Memorandum of Understanding to explore the development of sustainable ocean data centres.

This partnership aims to develop proof-of-concept and pave the way for offshore data centres that address land scarcity and energy-efficiency challenges.



### Growing Negative Emission Capability

Sembcorp Marine's wholly-owned subsidiary, Sevan SSP AS, was part of a consortium to develop a large-scale maritime concept for transport and injection of CO<sub>2</sub> for permanent storage in subsea reservoirs – comprising a CO<sub>2</sub> carrier and Sevan SSP Floating Storage Injection Unit.

## DELIVERING INNOVATIVE & SUSTAINABLE SOLUTIONS

# Advancing Towards Net Zero Carbon Future



**2030** Achieve 40% of annual company turnover generated from sustainable solutions



Sembcorp Marine's engineering design capabilities in ocean renewables are key to the Group in becoming a global EPC partner for energy companies in offshore wind projects and renewable segment.

- |                                                               |                                                |
|---------------------------------------------------------------|------------------------------------------------|
| 1 Substation – HVDC (High Voltage Direct Current)             | 7 Wind Electrification FPSO                    |
| 2 Energy Hub [CCUS]H <sub>2</sub> /NH <sub>3</sub> Generation | 8 Floating Wind Technology                     |
| 3 Bottom-Fixed Wind Turbine                                   | 9 Floating HVDC Substation                     |
| 4 Floating Wind Technology                                    | 10 Carbon Capture (Utilisation) Storage (CCUS) |
| 5 Offshore Wind Turbine Installation Vessel                   | 11 Ammonia (NH <sub>3</sub> ) Carrier          |
| 6 Hydrogen-driven Wind Farm Crew-Transfer Vessel              | 12 Hydrogen (H <sub>2</sub> ) Bunker           |
|                                                               | 13 CO <sub>2</sub> Carrier                     |