BIBBY MARINE LIMITED

DECARBONISING BY ELECTRIFYING

FIRST IN CLASS ELECTRIC SOV

BIBBY
MARINE LIMITED

Over 200 Years of Maritime Expertise

Founded in Liverpool in 1807, we are one of the UK's oldest family-owned business with more than 200 years' experience in the maritime industry.

Bibby have operated vessels across the maritime sector, from passenger liners, bulkers, tankers and specialized offshore vessels.

Bibby Marine Ltd is part of Bibby Line Group, a diverse global business, operating in 12 countries, employing over 1300 people in financial services, marine and construction equipment hire.

"Mary Bibby" in Liverpool Harbour, 1825

"The Liverpool Bridge" Oil-bulk-ore carrier

Bibby Marine Ltd owns and operates the British-flagged Bibby WaveMaster fleet of Service Operation Vessels (SOVs). Bibby WaveMaster 1, **the first of its kind in the industry,** and Bibby Horizon provide accommodation and walk-to-work support services for the offshore wind and energy industries.

We also own and operate five floating accommodation barges, that offer flexible, affordable and comfortable shoreside and near shore accommodation, worldwide.

Continuing our historical pioneering spirit, we are now building the world's first electric charging SOV – designed to meet the needs of the market, while fulfilling our decarbonisation requirements to meet net-zero emissions targets.

Bibby Stockholm

Bibby Challenge

Bibby Renaissance

Bibby Bergen

Bibby Progress

Fleet Locations

Bibby Wavemaster One

Bibby Wavemaster Horizon

Bibby Wavemaster TBN

BIBBY MARINE LIMITED

Bibby Marine Ltd owns and operates the British-flagged Bibby WaveMaster fleet of Service Operation Vessels (SOVs). Bibby WaveMaster 1, **the first of its kind in the industry,** and Bibby Horizon provide accommodation and walk-to-work support services for the offshore wind and energy industries.

We also own and operate five floating accommodation barges, that offer flexible, affordable and comfortable shoreside and near shore accommodation, worldwide.

Continuing our historical pioneering spirit, we are now building the world's first electric charging SOV – designed to meet the needs of the market, while fulfilling our decarbonisation requirements to meet net-zero emissions targets.

BIBBY MARINE LIMITED

Vision of being “A family business, known for creating a better future together”

Building Tomorrow’s Green Future Today

Our vision

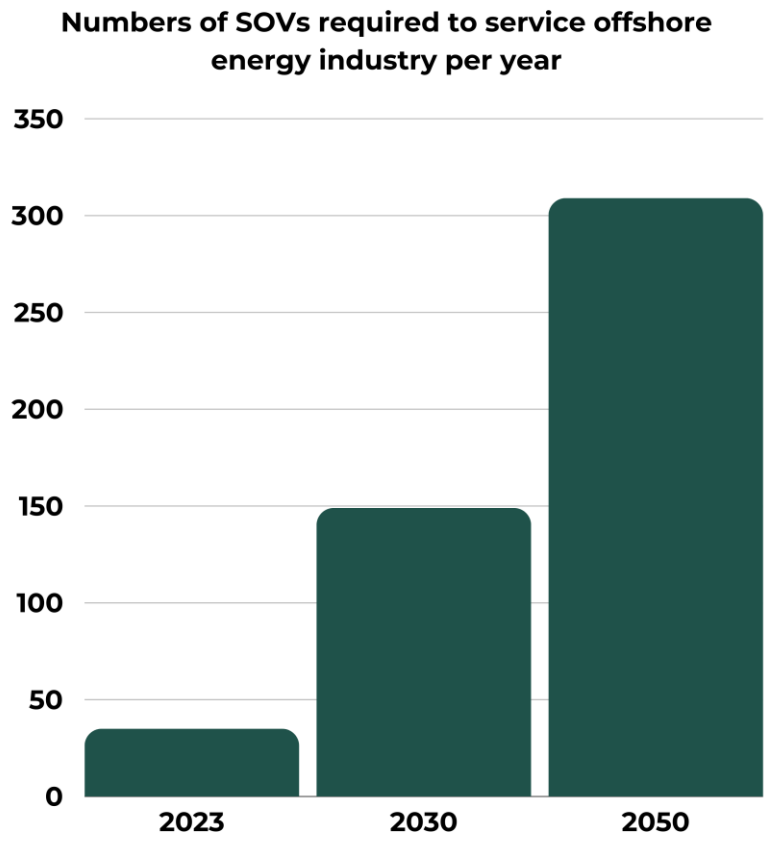
To be the UK’s cleanest SOV operator and to operate a zero-emission SOV before 2030.

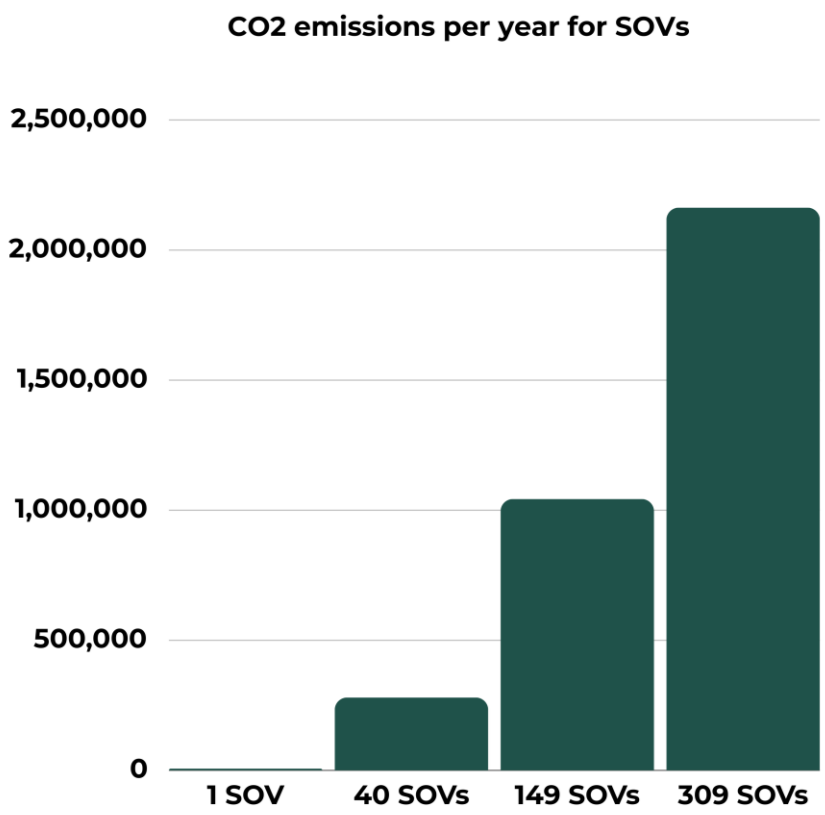
To be a positive influence in the energy transition and to drive innovation

Our commitment to innovation and sustainability drives us towards zero-emission solutions, which not only helps us, but also our clients, in reaching their long-term sustainability goals

Pledge to reduce our emissions, signatories of COP26 and members of Operation Zero which promises clean OSW support vessels in North Sea beyond 2025

The Challenge of Net Zero





*estimated figures according to the Maritime UK Offshore Wind Plan 2023

Each fossil-fuelled SOV emits more than 7,000 tonnes of CO2 each year - the equivalent carbon saving of 1.5 years of one wind turbine - equating to **175,000 tonnes over the 25-year design life** of the vessel.

Based on a carbon offset cost of $100/tonne, this would represent a substantial financial burden of over $0.7m annually, or **$17.5M over the vessel's lifetime.**

BIBBY MARINE LIMITED

The Challenge of Net Zero

Our new vessel has the potential to save Signiant fuel savings for our clients

Despite these figures in our market alone, we are seeing customers less willing to **“take the leap”** – to decarbonise their assets and they are still willing to buy fossil fuelled vessels.

Customers are still buying “old technology”, ready for ……

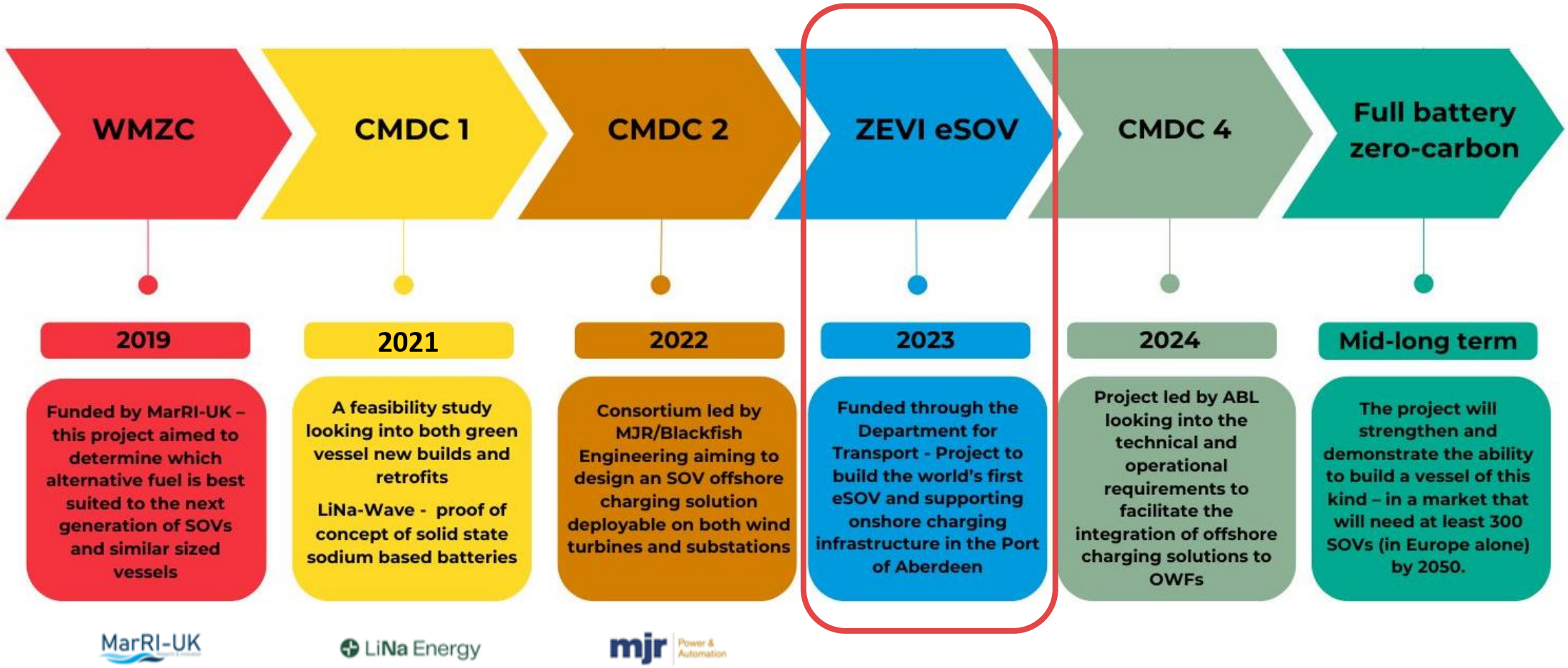
As a vessel owner / operator we are taking a **leap of faith in building the world’s first electric Service Operation Vessel (eSOV) – Driving Industry Change (Chicken and the Egg)**

Other sectors have accelerated their clean journey ahead of the maritime sector

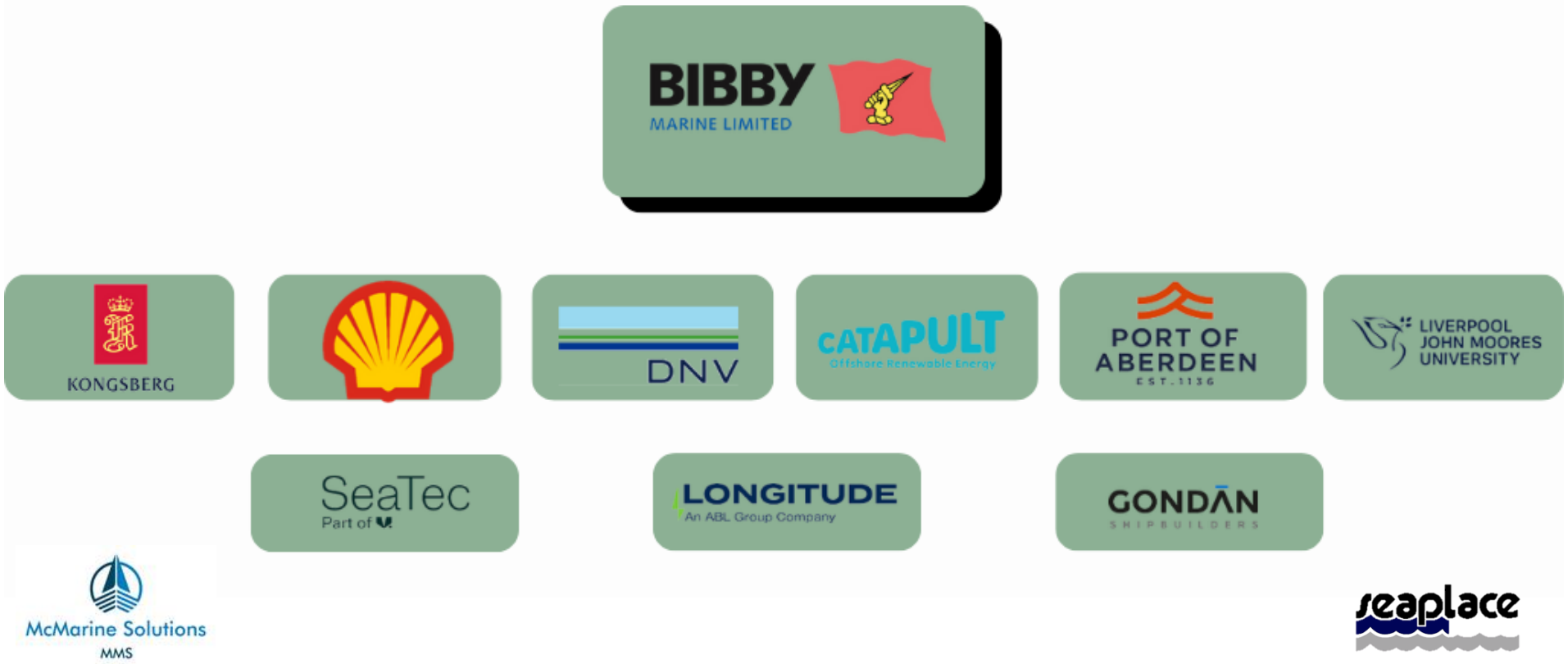
It is a complex issue, however there are solutions…

Our Roadmap to Green

We began looking for these “solutions” in 2019, when we began our “roadmap to green”



ZEVI Partners and Subcontractors



Design Premise

The design philosophy stems from our work during the WaveMaster Zero C (WMZC) project which came to a close in 2022. The outcome of this study showed that a battery plug-in hybrid, combined with methanol fuel was the most viable solution to meeting ultra-low /'zero' emission operation today.

The choice for adopting a **large battery pack** (large enough to sustain operations by itself) over other solutions is summarised by the below:

1. **Ideally the vessel will spend its life in a wind field, giving the option to be able to charge from this source directly is an elegant fit.**

2. **Battery technology is proved and ready today – other green alternatives are not**

3. **The SOV market is moving towards electrification, as the offshore charging infrastructure grows and becomes the norm, fully electrified vessels will be the only viable option to meeting in field zero emission operations.**

Electric Commissioning Service Operation Vessel eSOV

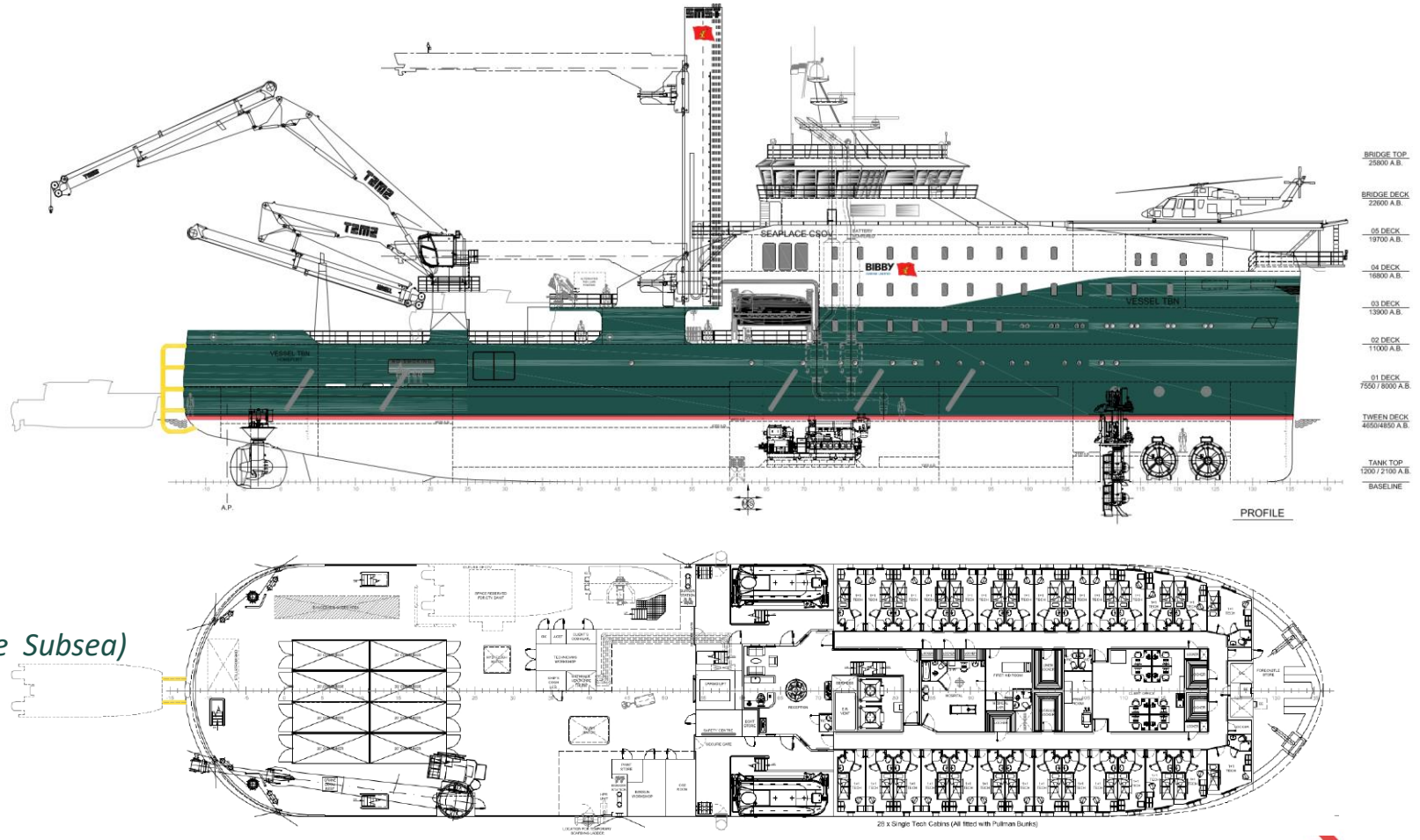
Bibby's new vessel will be at **the forefront of the offshore W2W market, offering unparalleled emission reductions and fuel consumption**. With its market leading battery pack and methanol fuel system combined, she will be the **first true zero emission SOV**, having the ability to operate on battery alone for significant periods.

- **First electric vessel in its class**
- **Large ~25Mwh battery**
- **1000v DC power system – 3 Way Split**
- **Dual Fuel Methanol Engines – Range Extender**
- **Offshore Charging Ready**
- **Shore Charging ready**
- **Highly capability & Redundant DP2 position keeping**
- **Class leading mission equipment**
- **High end accommodation / Outfitting**
- **'Digital Ready' AI**

bibbymarine.com

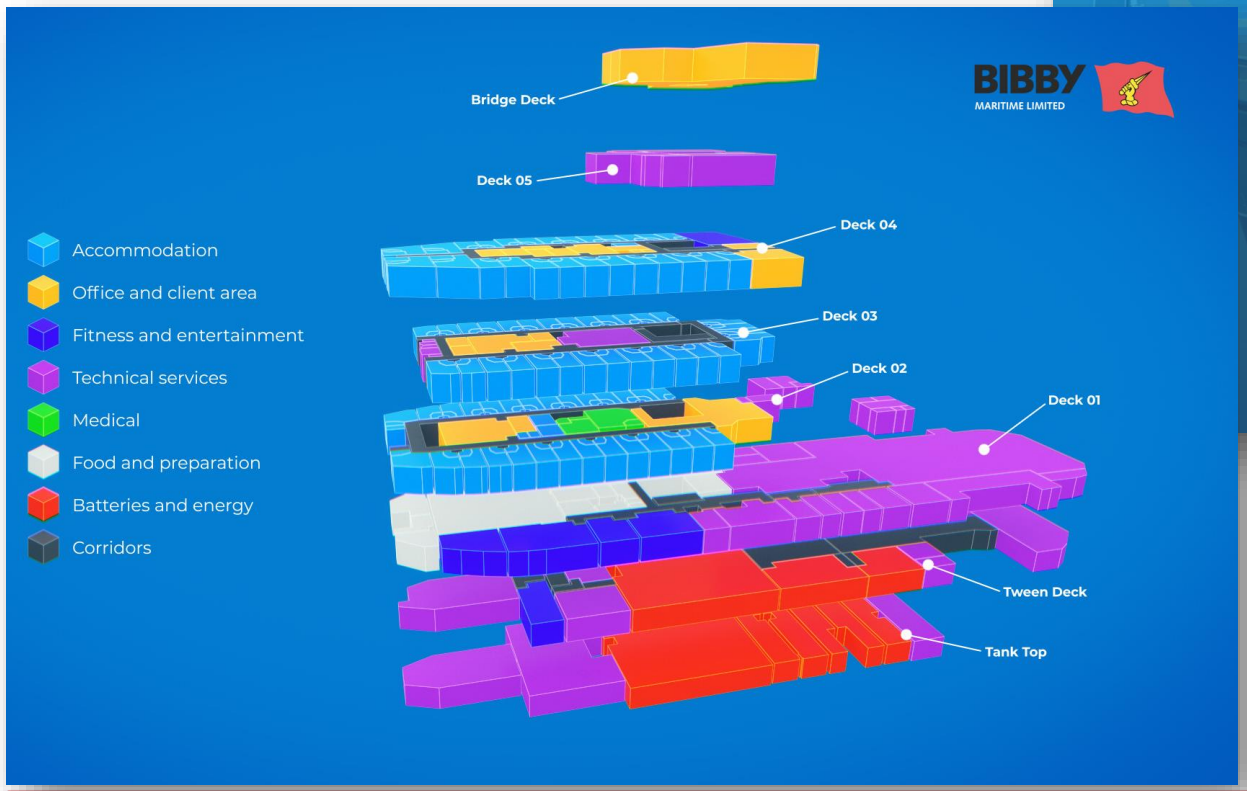
Vessel Specification

Length Overall	90.00m
Breadth Moulded	19.80m
Depth Moulded	7.55m
Draught (Design)	5.00m
Seed (max.)	13.0 knt
Ship's Crew	24 Persons
Technicians	60+36 Persons
Total POB	120 Persons
Fuel	Methanol + Diesel
Battery	25Mwh (5 Split)
Engines	2x 3.48MW
Crane	10Te 3D *(Upgradable to 40Te Subsea)*
Gangway	3D, 30m P&S operation
Helideck	21m/12.6Te (S92A)
Deck Space	~500m^2
Insulated Warehouse	~550m^2
Powerful DP	(9,8,8,6), Closed BUS notation
Installed Thr Power	8.2MW



Purpose Built SOV Design from the ground up

Vessel Specification

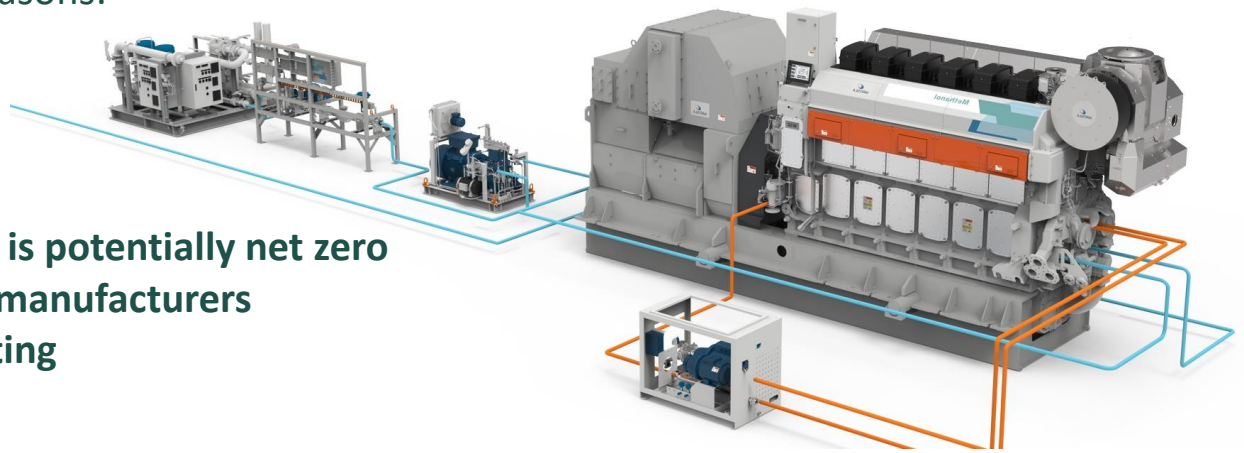


Methanol Fuel

High pressure injection for 90-99% Methanol

In addition to batteries, as part of the WMZC project we investigated several marine fuel alternatives, Methanol, Biodiesel, Ammonia and Hydrogen (liquid, gaseous and LOHC). Incorporating engines into the design allows for periods when offshore charging may be unavailable, and when long passages (e.g., port calls) are required.

Methanol was chosen as the most viable option for the following reasons:



1. **Shortest roadmap in coming to market (other than biodiesel)**
2. **High energy density (second to biodiesel)**
3. **Safe/easy storage at atmospheric conditions**
4. **Green methanol (produced using renewables/captured carbon) is potentially net zero**
5. **Dual fuel methanol/MGO engines available today from several manufacturers**
6. **Training and certification for handling of methanol already existing**

Other fuels were discounted for the following reasons:

Biodiesel – no CO2/NOx emission reduction compared to MGO
Ammonia – safety concerns as extremely toxic
Hydrogen – Low energy density, supply chain roadmap, difficult/dangerous to store, LOHC very low TRL

Operation

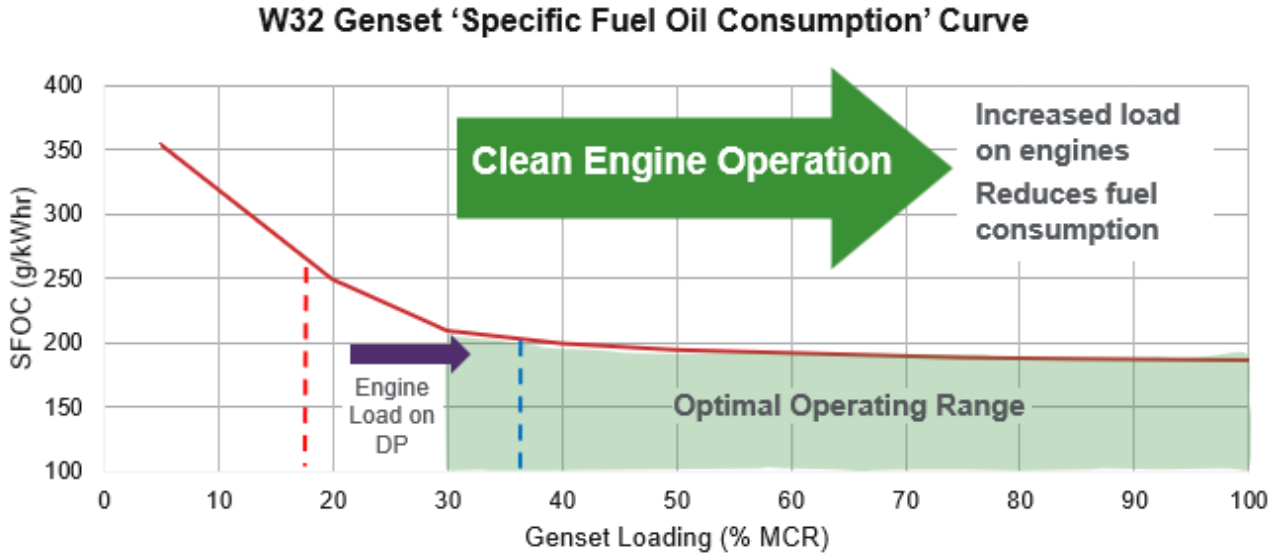
High efficiently engines, up to 1% MGO fuel on high pressure injection

Operative at optimal efficiency at all times, 85% MCR (acc in SFOC curve) charging battery to 90% then switching off

Engines provide power for vessel loads (thrusters + hotel etc plus battery charging)

Other ‘hybrid’ vessel operate engines at the load that the vessel requires, **operating at sub optimal loads**

Large battery allows for **optimal fuel use while keeping maximum redundancy**



Engines sized for optimal operation in charging

Operation predominately on batteries

Battery Power Pack

The battery system for this vessel was calculated after detailed analysis of operational data from existing BML vessels and the anticipated operational profile for a new eSOV when utilising future, offshore in field charging.

The battery has been sized to ensure a guaranteed (by OEM) **life span of 12-years**, with an expected life span of up to 15-years, based on the anticipated daily usage cycles for battery operation and charging cycles.

Lithium-Ion Phosphate (LFP) chemistry was selected for the batteries on this vessel, with a **total installed power of 25MWh**, split equally into five onboard zones.

The main drivers for the final section of LFP batteries on this vessel were safety[1], energy density[2], lifespan, environmental properties and the financial stability of battery supplier.

1. When compared to Nickel, Manganese, Cobalt (NMC) batteries, 2. When compared to LTO

Operational Profile – *Without Offshore Charging*

FEED study conducted to establish an accurate operational profile, allowing for accurate battery sizing and anticipated fuel savings.

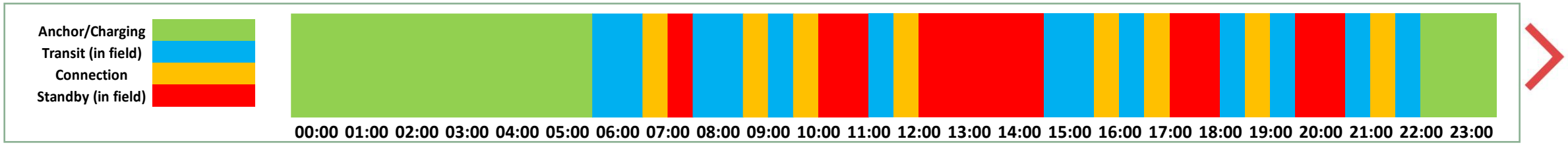
Typical offshore windfarm

- >18 Hour battery endurance in good weather (1.5Hs),
- >12 Hours @ 2.5HS
- Charging from dual fuel engines
- Relaxed DP at night

Typical operational profile – Offshore charging	
Number of connections to the turbine	10
Distance sailed per day (in field transit at 6 knots)	**40 NM**
Estimated wave height	Hs 1.5m
Power Required/day	**16.6MWh**
Average Daily Fuel Consumption *(including full operational profile, port call etc)*	**~3-4t**

35 Day Vessel Endurance on either Methanol or MDO

Typical day of operation



Operational Profile – *With Offshore Charging Available*

With offshore charging available the vessel will be able to complete all typical operations under zero-emission.

- >18 Hour battery endurance in good weather (1.5Hs),
- >12 Hours @ 2.5HS
- **Based on 1.5 Charge cycles per day**
- Dual Fuel Engines ready to come online for safety/emergencies
- Connected to charger at night

Typical operational profile – Offshore charging	
Number of connections to the turbine	10
Distance sailed per day (in field transit at 6 knots)	**40 NM**
Estimated wave height	Hs 1.5m
Power Required/day	**16.6MWh**
Average Daily Fuel Consumption *(including full operational profile, port call etc)*	**0t**

Full charge = transits up to 130NM @10kts on battery alone

Learning from this project will help us to optimise future vessels and reduce capex investment

Offshore Charging

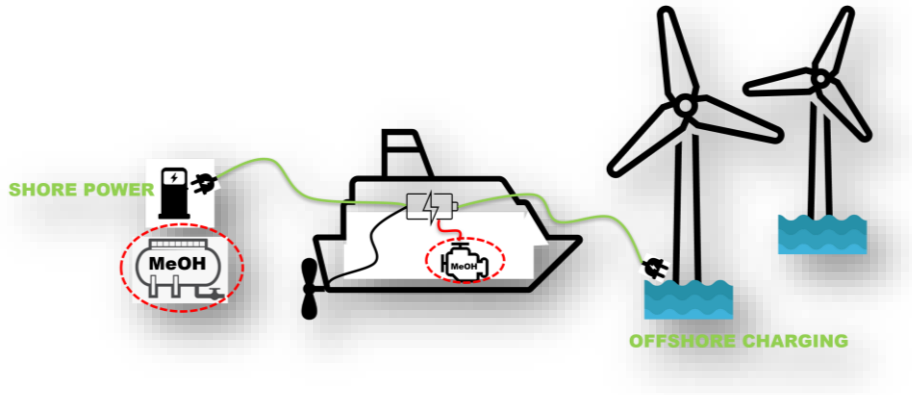
We are working with class (DNV) on adoption of first class notation for offshore charging and have a technical collaboration agreement with StillStrom

Offshore charging is critical to the efficient operation of this vessel.

Our eSOV will be a differentiator in the market and we envisage it will drive the widespread adoption of the offshore charging infrastructure.

Several suppliers on the market offering similar solutions.

Standardisation of solutions is key (Connection, Power etc)



Our vessel shall be fully prepared for offshore charging

- All hardware installed for 11kv AC charging at up to 6Mwh 50Hz
- PMS mode for offshore charging **(full SoC achievable in 4-5 hours)**
- Specialised DP mode for offshore charging
- All vessel services provided for charging skid and connection (Fwd and Aft locations)
- Option for future upgrade to DC charging (floating installations)

Shore connection

Most efficient operation shall be when batteries are charged at port, allowing for battery transit to location whilst having zero fuel burn in port

Vessel power system and electrical hardware is designed for flexibility of operation

- 440V – LV AC Standard shore connection (50Hz)
- 690V – LV AC connection for battery charging (50Hz)
- 11kV – HV AC connection for battery charging (50Hz)
- Option for DC charging

For battery charging ~2MWh required, assumed reduced charging rate during overnight port stay

Exact connection type and arrangement TBC port infrastructure. We are working together with several suppliers.

Challenges

On-Going Challenges

We recognise there are a few barriers to the success of electric vessel solutions in the maritime sector.

Availability of on-shore charging, grid capacity and standardisation of connection

Widespread adoption of offshore charging, standardisation for connections / power, commercial agreements on power delivery / day rates etc

Availability of e-Methanol, cost delta (>5x) from conventional fuels and bunkering facilities

Push from government and operators required, EU emission tax

This project is a catalyst for innovation

The Future

Fleet Expansion - Bibby have ambitious plans for our green fleet of zero emission SOV's.

UK Shipbuilding - Bibby is committed to UK shipbuilding in the longer term, working closely with DFT and NSO for future opportunities with UK yards. Working on ways to bridge the pricing and skill gap from both European and far east yards.

Helping Deliver Government policy: Under the UK Government's 10 Point Plan for a Green Industrial Revolution, UK build, clean operating vessels are seen as vital to the UK economy.

Department for Transport

National Shipbuilding Office


BIBBY
MARINE LIMITED
Questions