

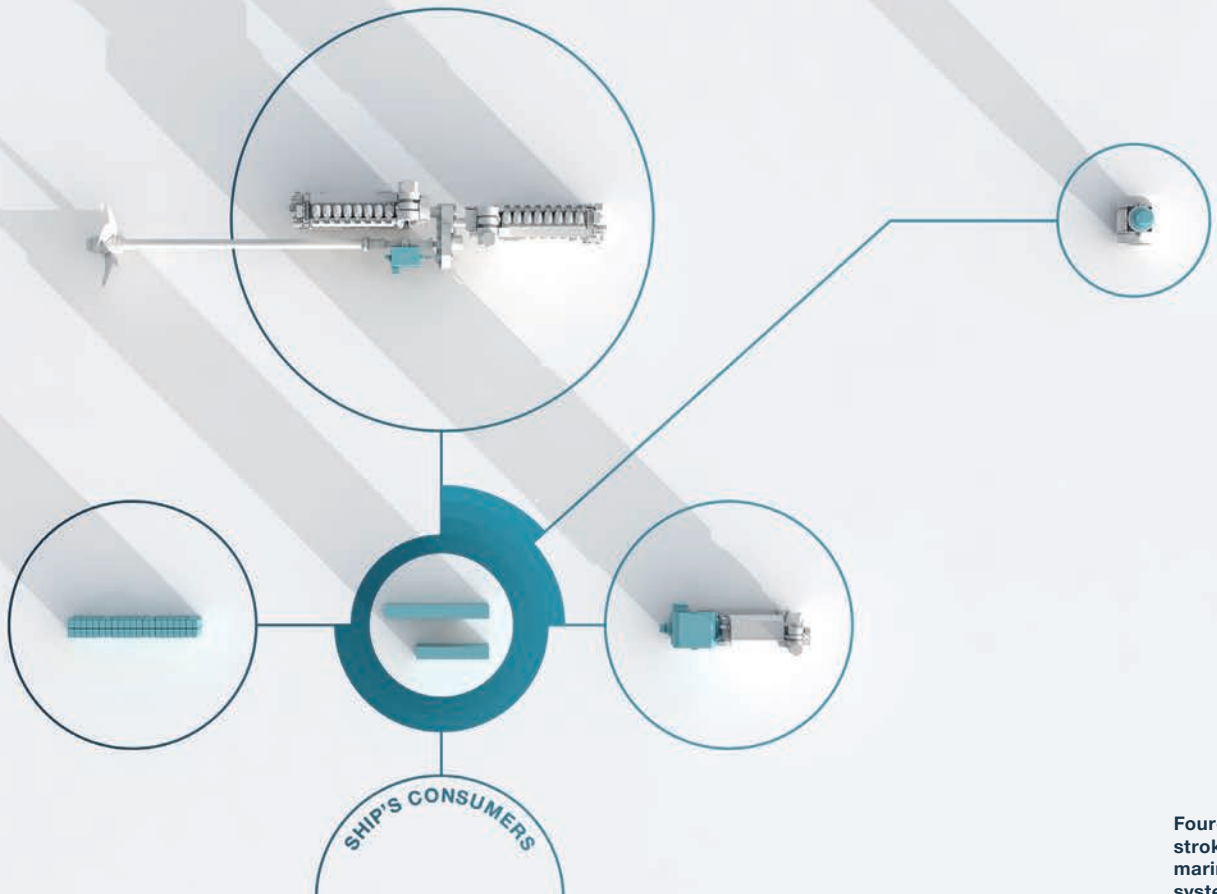
# Hybrid marine propulsion systems

Hybrid propulsion systems for marine applications combine combustion engines with battery power to optimize engine operation while reducing emissions. These are ideal for vessels with flexible operation profiles and running hours with varying power demands.

The new MAN solutions reduce fuel consumption, greenhouse gas emissions, maintenance costs and noise production, while increasing revenue and technical efficiency.

## Benefits at a glance

- Fewer NO<sub>x</sub>, SO<sub>x</sub> and CO<sub>2</sub> emissions
- Zero emissions when just batteries are used (especially at slow speeds or harbor)
- Increased fuel efficiency
- Silent operation
- Wide range of operation modes



# Flexibility and efficiency optimally combined

## Reducing your carbon footprint

The shipping industry is responsible for transporting over 95% of all goods traded around the world today. Many ships, like cruise liners and tugs, travel in environmentally sensitive areas. To do so, their engines need to meet very strict emission regulations. IMO Tier III, emission control area (ECA) and energy efficiency design index (EEDI) regulations define the limits for all vessels sailing in international waters. The global response to the devastating effects of pollution and global warming on marine ecosystems is to adopt even tougher rules for emissions, as seen at the 2015 Paris Climate Conference (COP21).

## Reliability and reduced emissions

MAN Energy Solutions offers fully tailor-made propulsion and power generation solutions, including all components such as main engines, GenSets, switchboards, converters, electrical motors, energy storage systems, gear boxes and propellers. Hybrid propulsion optimizes the fuel efficiency of vessels that have a flexible power demand, such as fishing vessels, tugs and RoPax. The combination of mechanical power from diesel engines and electrical power from electrical motors assures the vessels a broad operational capability. Reliability is ensured by our all-round competence in the field.

## General competence

MAN Energy Solutions unites comprehensive technologies and competencies under one roof including high and medium speed engines and gensets, injection systems, turbochargers, control and after-treatment systems, as well as complete mechanical and electrical power and propulsion trains.

Together with Aspin Kemp & Associates (AKA), we provide complete system solutions for electric and battery-hybrid propulsion. AKA's specialized expertise is the integration of electric propulsion and energy storage systems as well as providing power management controls. In our battery hybrid propulsion solutions, the energy management system (EMS) controls the generation, storage and distribution of power and energy, optimizing the overall performance of the propulsion system, increasing safety and system reliability. The EMS reduces life cycle costs and lowers fuel consumption. It also enables the smart application of emission-free and silent operation.

## System solutions

### MAN HyProp ECO

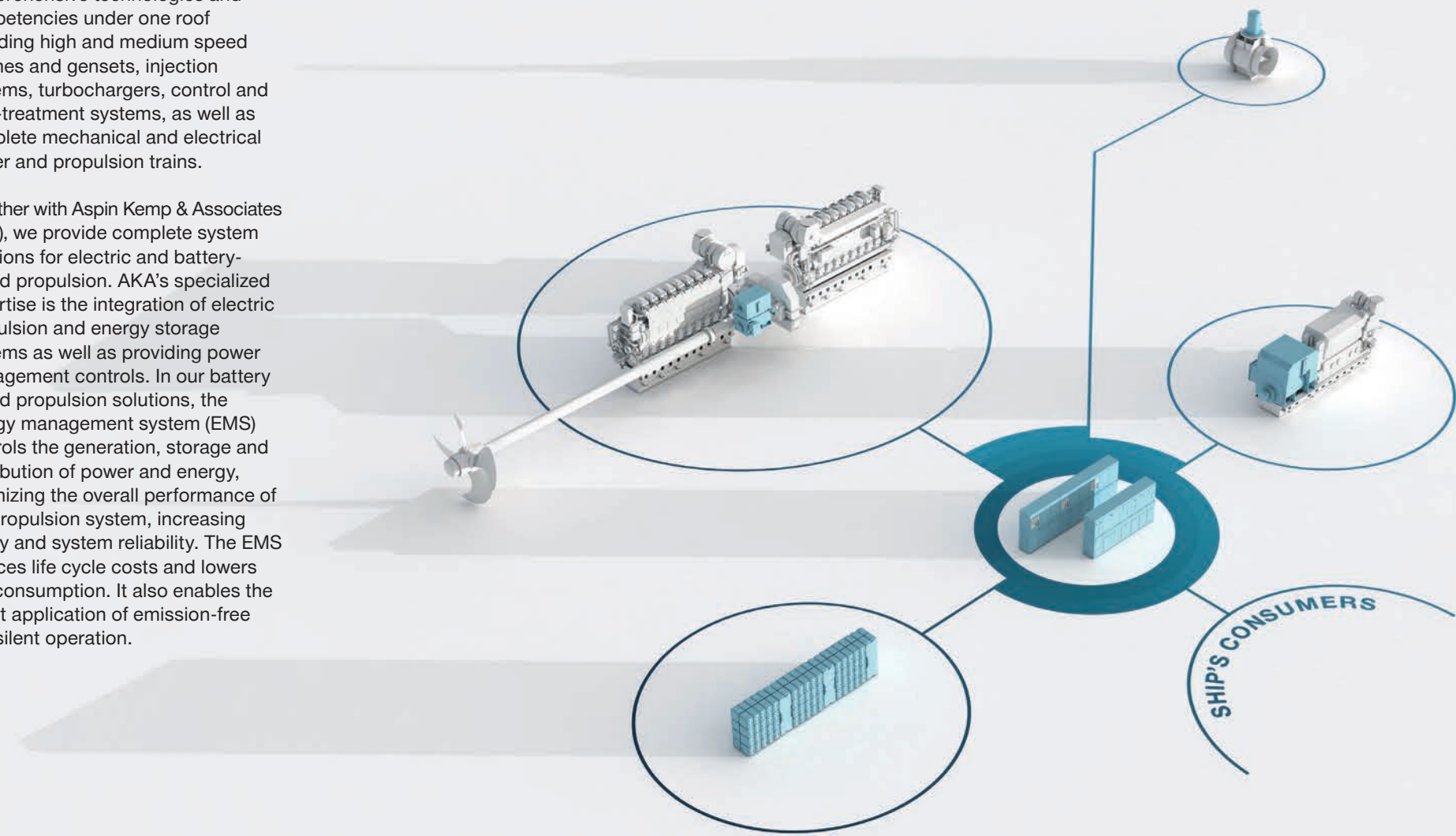
MAN HyProp ECO is a flexible hybrid propulsion system for controlling the power delivered by or to the shaft machine in the most efficient way. It overcomes the constraint on constant speed propulsion machinery by utilizing variable speed drive (VSD) technology at the shaft generator/motor. MAN HyProp ECO can reduce fuel oil consumption by 10 – 15%.

### MAN HyProp Battery

In a MAN marine battery-hybrid system, batteries are used as an additional, independent source of power for propulsion and hotel loads. Battery storage solutions enable an optimized loading of the engines, provide electrical spinning reserve, dynamic support of the propulsors and peak shaving. At the same time, batteries can increase the reliability of the complete power train as well as its performance due to faster system reaction times.

## Key components

- **Main engines**  
Fuel-efficient, powerful and reliable four-stroke high and medium speed propulsion engines.
- **Auxiliary GenSets**  
Reliably deliver power at a low cost per kWh while respecting the environment.
- **Propellers, gearboxes, and propulsion control systems**  
Efficient propulsion solutions delivered under the MAN Alpha brand.
- **Transformers, switchboards, distributions**  
AC and DC switchboards, including power management, electric power distribution with balancing power generation and consumption.
- **E-motors and variable speed drives and control systems**  
Components used to drive the propellers.
- **Energy storage systems**  
Batteries and further devices, like SuperCaps. Selection made on duty cycle.
- **Energy management system**  
Optimized control of all power sources.



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