Royal Institution of Naval Architects

"*Marine vessels and structures are technically complex and operate in a challenging environment. The Institution is committed to contributing to a reduction of their environmental impact and improving their energy efficiency by providing guidance on their design, construction, maintenance, operation, decommissioning and recycling in order to achieve more sustainable use of resources and mitigate climate change."*

"DESIGN FOR THE MARITIME ENVIRONMENT"

Environmental Considerations in the Design of Marine Vessels and Structures

Society expectation and regulation require that the maritime industry be fully sensitive to the environment through the reduction of harmful emissions, contamination of the seas and more efficient use of sustainable resources. The thoughtful design and construction of marine vessels and structures can have significant influence in achieving these.

This aide memoire describes those aspects of marine vessels and structures that have an impact on the environment, and how that impact can be mitigated through design. It is intended to provide a broad overview of environmental design considerations and not a detailed reference to design and associated regulation.

Design Area	Design Objective	Design Aim	Environmental Benefit
Hull Form	• Minimise fuel consumption. • Reduce wake • Maximise comfort	• Optimise hull form, appendages and strength for intended duty and speed. • Minimise hull resistance	• Reduced emissions • Reduced seabed and coastal erosion
Hull Life	• Reduce maintenance, • Reduce material and energy requirements	• Design for predicted life, and consider materials used	• Reduced energy demand.
Propeller(s)	• Minimise fuel consumption • Reduce noise.	• Optimise propeller design for intended duty and speed • Optimise interaction with hull and rudder	• Reduced emissions • Reduced seabed and coastal erosion • Reduced impact on marine life
Compartment division and configuration	• Maximise operational efficiency • Minimise time in harbour • Minimise human effort • Minimise use of material	• Arrange cargo configuration to provide ease of loading and unloading • Arrange compartments to maximise crew effectiveness in ship operation	• Reduced energy requirement • Increased safety
Superstructure	• Minimise wind resistance • Minimise windage effects for ship handling • Reduce fuel consumption	• Design for intended duty and speed	• Reduced emissions • Increased safety
Machinery Location	• Minimise maintenance and repair downtime • Minimise maintenance manpower and energy requirement	• Design for ease of installation, operation, repair and replacement • Optimise loading	• Reduced energy requirement
Machinery Uptakes and Downtakes	• Increase machinery efficiency • Reduce fuel consumption • Reduce noise	• Optimise to reduce friction and pressure losses and improve combustion	• Reduced emissions • Reduced noise pollution
Tank arrangements	• Reduce contamination risk • Minimise ship resistance/energy requirement • Minimise sullage discharge to sea	• Design to minimise spill risk • Configure for ease of liquid filling and transfer to optimise heel and trim • Design for ease of cleaning, sullage transfer and storage • Maximise integrity of fuel supplies to ships machinery	• Reduced emissions • Reduced risk of environmental damage • Reduced risk of propulsion failure resulting in pollution.
Coatings	• Maximise time between recoating • Extended ship life • Reduce energy requirements	• Specify longlife eco-friendly low VOC paint systems • Use fuel saving coatings	• Reduced impact on marine environment • Reduced emissions

Design Area	Design Objective	Design Aim	Environmental Benefit
Detailed design	• Reduce construction time and effort • Reduce use of materials	• Minimise number and scope of construction activities	• Reduced energy requirement
Modern materials	• Reduce weight • Extend life • Reduce corrosion • Reduce fuel consumption	• Optimise material use. • Maximise use of lightweight and composite materials	• Reduced emissions • Reduced energy requirement
Propulsion	• Reduce carbon based fuel consumption	• Maximise use of renewable energy sources	• Reduced emissions
Modernisation and upgrades	• Allow for possible change requirements to initial design with minimal work	• Anticipate any changes that may be required during the ship life	• Reduced material use • Reduced energy requirement
Recycling	• Minimise recycling effort and impact	• Maximise use of recyclable materials • Minimise use of toxic materials	• Reduced waste material • Reduced energy demand • Reduced toxin pollution