

Towards Zero

Justin Ratcliffe sits down with Lateral Naval Architects to discover more about their push toward a more sustainable yachting industry

Yachting has traditionally had an easy ride when it comes to emissions, perhaps because the pollution happens over the horizon or under the water. Not anymore. IMO Tier III standards have challenged stakeholders to find new technological solutions to reduce harmful emissions, and the regulatory landscape is set to confront not just local pollutants such as nitrous oxides, sulphur and particulates, but also global carbon emissions. With most national and international climate goals aiming for net zero by either 2030 or 2050, the drive towards a zero emissions future is now mainstream.

Sustainability is now high on the list of priorities for yacht builders, not least because they want to be ahead of the legislative curve. But the demographics of yacht owners and charterers is also shifting to a younger generation with a different buying motivation and belief system in which 'leave no trace' is a growing consideration.

"But we have some way to go," said James Roy, Managing Director of Lateral Naval Architects (LNA), in a presentation entitled 'Moving Towards Zero' during the 2021 Superyacht UK Technical Seminar. "I will be quite frank and say that greenwashing is rife, not just in our industry but across all industries. We need to put greater meaning to the term sustainability in our industry, because being 'green' - whatever that really means - is about more than just reducing emissions."

Roy based his presentation on specific research carried out by LNA in response to an enquiry from a client about the carbon footprint of a yacht that had come on the market and he was thinking of buying.

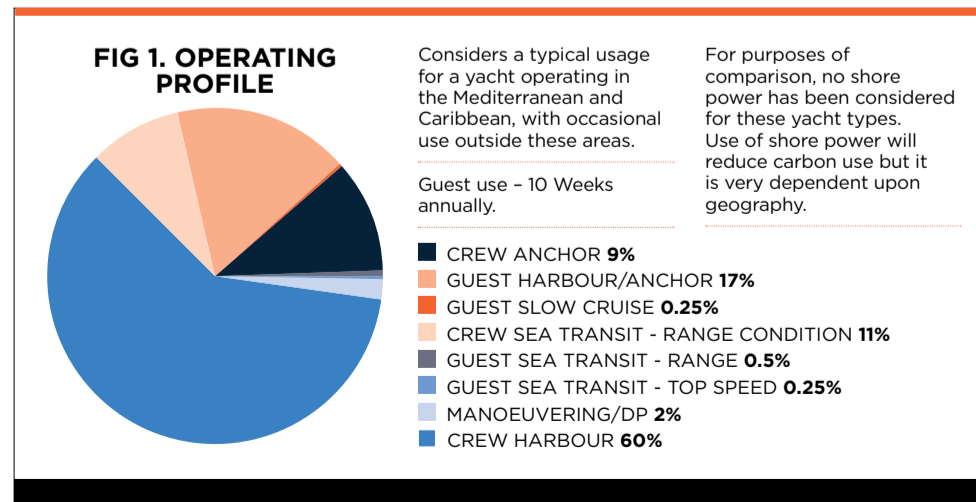
"We were a bit nonplussed, because when you have that number what are you going to do with it and how is it going to inform your decisions?" asks Roy. "So we responded with a comparative study of different superyachts that asks whether a sailing yacht really does have a smaller carbon footprint than a motoryacht and what factors have the biggest influence in reducing carbon emissions?"

Based on an average operational profile of 10 weeks guest use per year in the



Oceanco 109m Bravo Eugenia is equipped with energy-saving technologies and an efficient hybrid propulsion-system

TOM VAN GOSSANEN (2)



Med and Caribbean, the study basically takes as a baseline a standard 85-metre motoryacht of 3,000 GT with no special 'green' technology and compares it with an energy-efficient motoryacht of the same gross tonnage, a conventional sailing yacht of similar length, and an energy-efficient sailing yacht of the same approximate gross tonnage.

"The total carbon footprint of a yacht involves a multitude of factors, so we only considered carbon emissions from actual fuel burn and assumed shore power was not used," says Simon Brealey, Principal Mechanical Engineer at LNA. "This may seem unrealistic, but the study required



The 106.7-metre Black Pearl from Oceanco, an evolutionary sailing yacht with hybrid propulsion capable of crossing the Atlantic without burning any fossil fuels

compared to focusing on the hotel loads," says Brealey. "Clearly, this is not the case and there is a lot of low hanging fruit in terms of improving propulsion efficiency, even for boats that don't travel far."

In support of this argument, the study demonstrated that an energy-efficient motor yacht with an optimised hull form, hybrid propulsion and hotel loads generates 15% fewer carbon emissions than the conventional baseline yacht.

"That's a 15 per cent saving by just being smarter," Roy points out. "Although it does come at a higher initial cost because although the gross tonnage is the same, the slimmer hull is almost a third longer and the propulsion technology is more expensive."

The operational profile for the sailing yachts is the same as for the motor yachts, except the time at sea takes into account time under sail, time motoring and time motor sailing. Given the different dimensions and shapes of sailing yachts, one is of the same length as the baseline motor yacht but lower GT, the other is of comparable GT but longer in length.

"There's always a debate over how often large sailing yachts actually sail," says Brealey. "Much depends on the appropriate wind conditions, the difficulty of operating large rigs and associated maintenance. Most sea time happens during crew transits or longer passages, with only short spells of sailing during guest use."

In fact, the carbon saved during pure sailing is about 195 tonnes - a reduction of only 5% compared with the baseline motoryacht (some variation of values is likely for very keen sailors in ideal

FIG 2. CARBON DIOXIDE EMISSIONS MOTOR YACHT
ANNUAL CO₂ EMISSIONS PER OPERATIONAL MODE (TONNES)

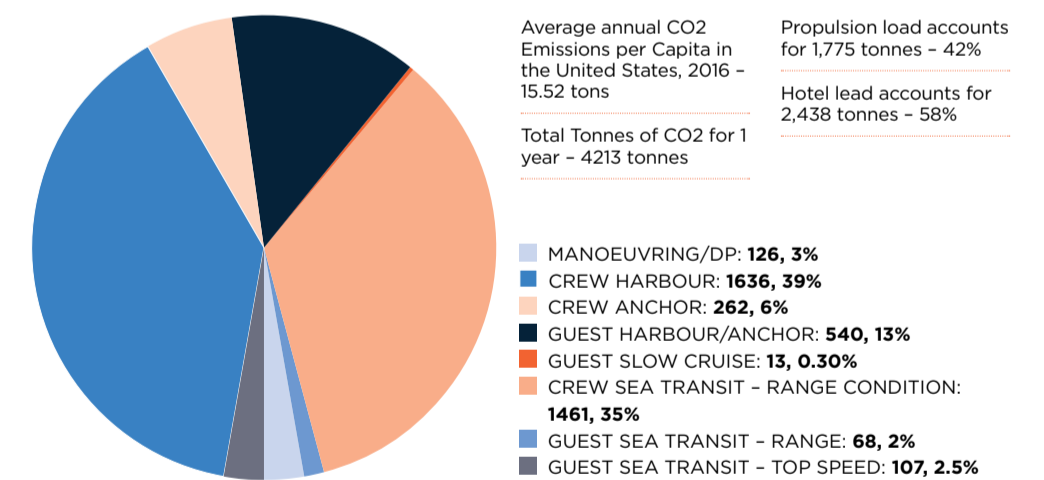
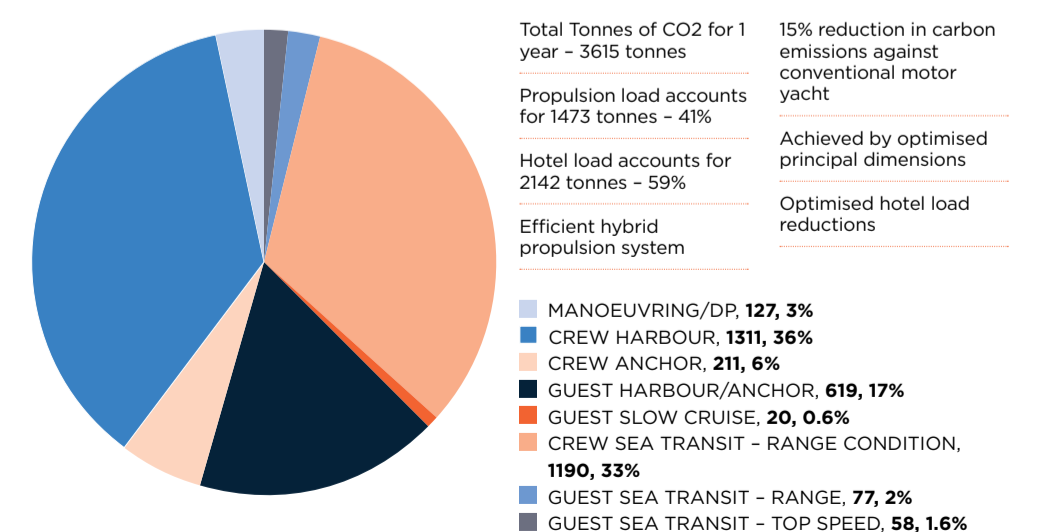
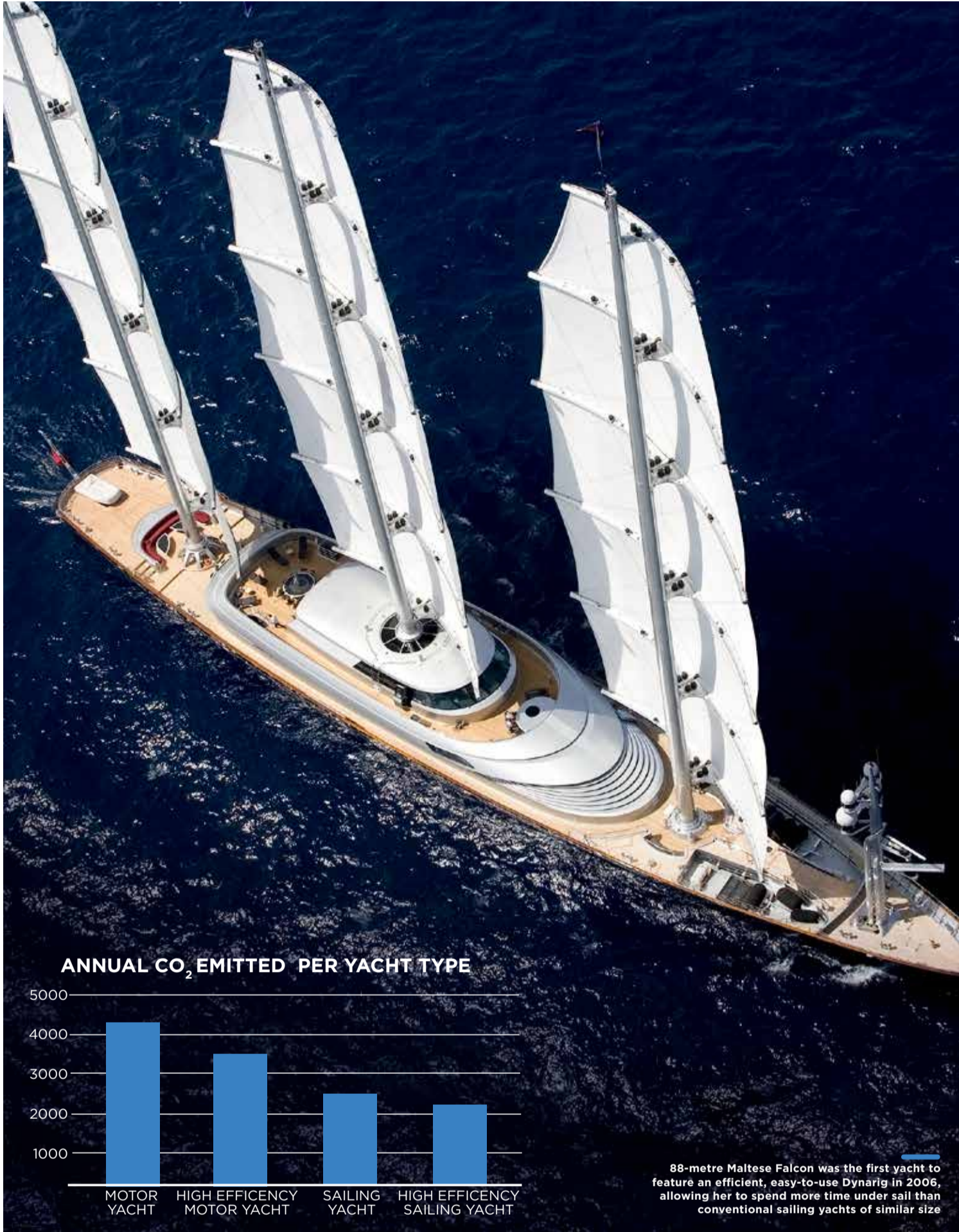
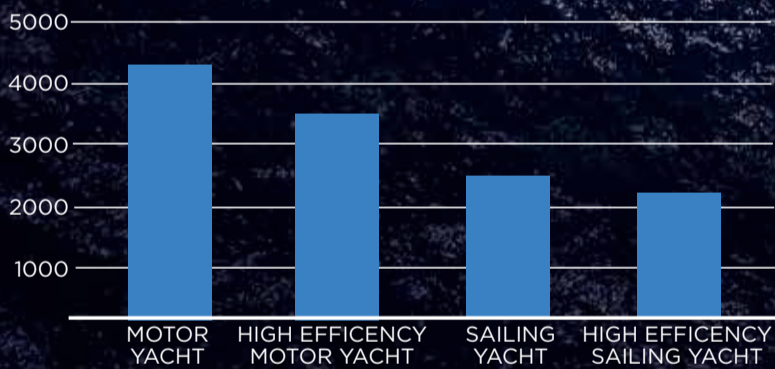


FIG 3. CARBON DIOXIDE EMISSIONS HIGH EFFICIENCY MOTOR YACHT
ANNUAL CO₂ EMISSIONS PER OPERATIONAL MODE (TONNES)





ANNUAL CO₂ EMITTED PER YACHT TYPE



88-metre Maltese Falcon was the first yacht to feature an efficient, easy-to-use Dynarig in 2006, allowing her to spend more time under sail than conventional sailing yachts of similar size

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conditions). Admittedly, the standard sailing yacht produces 40% less carbon overall than a conventional motor yacht, but this is mostly due to its smaller volume (approx 1,500 GT). What is interesting is that the hotel loads account for almost two-thirds of the total carbon emissions.

The best-in-class sailing yacht (approx 3,000GT), using easy-to-deploy and operate Dynarigs, shows more significant advantages with an overall reduction in carbon emissions of 48% compared with the baseline motoryacht of the same GT.

“We know from feedback from captains and clients that yachts with Dynarigs are used more often than traditional rigs because they’re easier to deploy and handle and can be used in more variable conditions,” says Brealey. “We also assumed the yacht is able to regenerate energy under sail power, which can result in carbon-free ocean crossings.”

As in the case of the energy-efficient motor yacht, however, complex high-tech sailing yachts carry a bigger initial price tag. Moreover, energy optimisation taken

to its logical conclusion could lead to compromises in guest comfort in terms of availability of air conditioning and other onboard amenities.

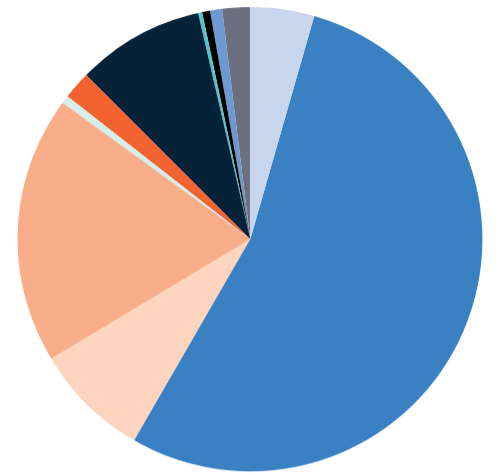
“The takeaway from all of this is that buying a sailing boat is not the panacea that people might think it is,” says Roy. “Not many owners are willing to spend the extra money or take the extra risk associated with building a super energy-efficient yacht and only a very small minority of innovators are prepared to take the technical and commercial risks needed to push the envelope. But they all are interested in future-proofing their investment and this has led to an owner profile that is driven by anxiety that the choices they make today will be obsolete in a few years’ time.”

LNA’s study is intended for comparative purposes only and the results cannot be compared directly with other yachts or calculation methods, but they underscore the requirement for a reliable yardstick for measuring the environmental credentials of large yachts. This is exactly

what the YETI (Yacht Environmental Transparency Index) project overseen by Water Revolution Foundation is trying to achieve. LNA is just one stakeholder collaborating on the joint industry venture that aims to provide the yachting industry with an important tool for comparing the environmental impact of different superyachts based on parameters from engine efficiency and shore power consumption to battery banks and waste heat recovery.

“We’re privileged insofar as we get to see the projects that don’t happen,” says Brealey. “For every energy-efficient yacht that gets built there are four or five enquiries for others that don’t get built. Until a few years ago, we were rarely asked to engineer a yacht based on efficiency as the primary objective. The standard specification focused on speed and range rather than fuel efficiency. The pursuit of efficiency requires a higher level of technical thought because we have to question the way we’ve done things to date. And that’s the fuel for our fire.”

FIG 4. CARBON DIOXIDE EMISSIONS - SAILING YACHT ANNUAL CO₂ EMISSIONS PER OPERATIONAL MODE (TONNES)



MANOEUVRING/DP	105	4.2%
CREW HARBOUR	1249	50%
CREW ANCHOR	187	7%
GUEST HARBOUR/ANCHOR	428	17%
GUEST SLOW CRUISE	12	0.5%
CREW SEA TRANSIT - SAIL	43	2%
CREW SEA TRANSIT - RANGE CONDITION	209	8%
CREW SEA TRANSIT - MOTOR SAIL	208	8.3%
GUEST SEA TRANSIT - SAIL	7	0.3%
GUEST SEA TRANSIT - RANGE	22	0.9%

Total Tonnes of CO₂ for 1 year - 2513 tonnes

Propulsion load account for 599 tonnes - 24%

Hotel load accounts for 1864 tonnes - 74%

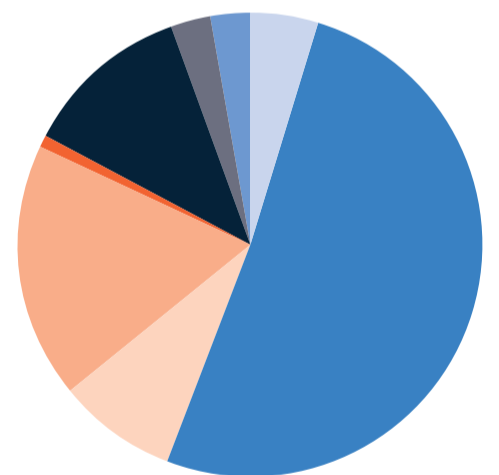
Reduction on carbon of 40% against conventional motor yacht.

Reduction on carbon as a result of sailing is 195 tonnes. I.e. 5% reduction from a conventional motor yacht.

The primary reason for the reduction in carbon emissions is due to size, relative to equivalent motor yacht.

Volume of Aquilo is 1,538GT compared to 3,000GT motor yacht.

FIG 5. CARBON DIOXIDE EMISSIONS - HIGH ENERGY EFFICIENCY SAILING YACHT ANNUAL CO₂ EMISSIONS PER OPERATIONAL MODE (TONNES)



MANOEUVRING/DP	106	5%
CREW HARBOUR	1118	51%
CREW ANCHOR	181	8%
GUEST HARBOUR/ANCHOR	389	18%
GUEST SLOW CRUISE	17	1%
CREW SEA TRANSIT - RANGE CONDITION	256	12%
GUEST SEA TRANSIT - RANGE	61	3%
GUEST SEA TRANSIT - TOP SPEED	57	2%

Total Tonnes of CO₂ for 1 year - 2,185 tonnes

Propulsion load accounts for 497 tonnes - 23%

Hotel load accounts for 1,689 tonnes - 77%

Overall reduction in carbon emissions is 48% from the same size conventional motor yacht.

Reduction in carbon is due to the assumption that the yacht operates in zero carbon sailing mode during transit. This is achievable more often due to power and relative ease of sailing.

Zero carbon sailing mode possible via novel rig design, focus on energy efficiency and hybrid propulsion system.