

# ENERGY-EFFICIENT YACHT DESIGN

The Lürssen Think Tank  
Technical Whitepaper

# THE LÜRSSEN THINK TANK

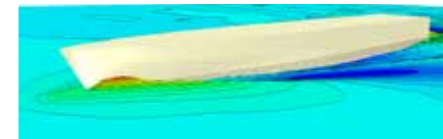
Recognising that its owners' high expectations for on-board comfort align with numerous environmental benefits, Lürssen is committed to developing energy-saving technologies that answer both issues. Dr. Lars Eggert, head of naval architecture at Lürssen, reveals how his team designs fuel-efficient yachts with significant reductions in noise and vibration through innovative hydrodynamics and propulsion systems.



## ENERGY-EFFICIENT YACHT DESIGN

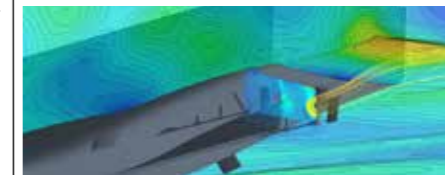
As part of Lürssen's goal to enhance on-board comfort, reduce carbon emissions and protect the environment, we design our yachts based on two fundamental design principles: reducing the power demand of the yacht as far as possible through optimised hull forms and increasing the yacht's fuel efficiency, while also reducing noise and vibrations, through intelligent propulsion systems.

The hull form defines the resistance of the yacht, which in turn defines the yacht's overall power demand. Optimisation of the hull form is, therefore, a key priority for Lürssen as it ensures fuel efficiency for our clients and reduced emissions for the environment. We have developed in-house parametric optimisation methods unique to our demands to create the optimal hull form for each project, not only for one speed or operational state but for the whole operational profile that the owner will require.



Wave pattern of an optimised hull form at full-speed condition.

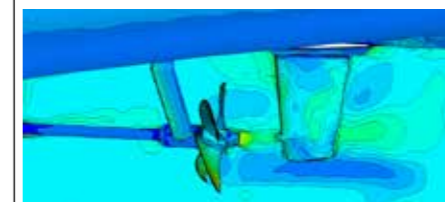
To find the best hull form configurations, we conduct long-term experience and automated optimisation algorithms through our own customised software technologies. This means that, unlike most other builders, we have the in-house knowhow and expertise to quickly assess the results of our findings and proactively react to any changes to the requirements, making the process of designing the hull form all the more streamlined and precise.



Visualisation of the flow around the highly efficient propulsion system.

Then, to further enhance the yacht's fuel efficiency and reduce emissions, we adopt intelligent propulsion technologies that may combine diesel engines with additional electric pod drives, enabling the use of various propulsion configurations that are the most optimal for the different operational states. For example, when the vessel is operating at a low cruising speed with the highest standards of noise and vibrations, an electric pod drive would be most suitable.

The overall power requirement of the yacht also depends on the performance of the propellers. As such, we focus heavily on finding the optimal propeller designs for each project in terms of fuel efficiency and noise and vibration. To push the boundaries of what has been achieved in superyacht propeller design, we incorporated a seven-bladed, noise-optimised propeller design on board a 150m-plus yacht – a concept based on our experience in other maritime sectors but not previously applied in yachting.



Efficient arrangement of the propulsion shaft line, propeller and rudder blade to avoid cavitation and vibration.

The main engines of Lürssen's projects are double-elastically mounted in a unique way to further reduce the noise and vibration emissions from the engines into the structure. We first did this on a 123m yacht with a conventional diesel engine and, on more recent projects with combined propulsion systems, we have incorporated not only the main engine and the gearbox on this common base train, but we also have an additional electric motor. While this is a more challenging arrangement, the benefits for on-board comfort are significant.

Finally, another innovation that Lürssen has developed is a yacht-optimised air injection system. This system works by creating an air cushion at the hull that dampens noise emissions from the propeller travelling into the yacht, as well as from the engines travelling outside the yacht. This system also has the potential to reduce the overall resistance of the yacht even further. Having implemented this system together with noise-optimised propellers on several projects already, we have seen outstanding benefits for reducing noise pollution on board the yacht and in the water.

In order to meet the future requirements of our clients and to continuously improve the environmental footprint of our yachts, every day we are seeking new innovative concepts, creating new ideas and thinking outside the box until we have found the best solution.

**LÜRSEN**