

Beyond frontiers

When it comes to greater sustainability and reducing emissions, the shipping industry needs to turn away from fossil fuels and find new energy sources. Fuel cells could pave the way into a green future on mega yachts

The German yacht builder Lürssen has earned an international reputation as the specialist in exclusive, bespoke yachts of outstanding engineering mastery. Innovation has always been one of the most important driving forces in the company's history.

In 1886 Lürssen built the first motorboat of the world together with Gottlieb Daimler. Since then, more than a hundred luxury yachts hit the water at the shipyards at Bremen and Rendsburg. Among the Top 30 of biggest vessels cruising the seven seas, 15 were built by Lürssen. The latest addition to the fleet was the 142 m project »Nord«, only recently delivered to Russian billionaire Alexander Mordashov.

For years, owners of newbuilds were concerned with the utmost luxury on board and numerous features such as mini-submarines, underwater salons and helicopter hangars. However, the focus on sustainability is also gaining in importance in yacht building. While engineers have always been keen to maximize the efficiency of ship operations, owners are now more and more demanding sustainable designs and technical solutions.





The energy demand on board luxury ships is considerable. It is needed for propulsion, but even more so for hotel operations, for a variety of equipment such as heating and air conditioning, the galleys, spas, bars and all the other amenities that the owners and their guests want to enjoy. To date, modern combustion engines or generators are used to provide the amount of power needed.

When it comes to greater sustainability and reducing emissions, the shipping industry must turn away from fossil fuels and find new, green energy sources. These can be alternative fuels. Or new technologies can be used that shipbuilding has never known before. The family-owned company Lürssen, led in fourth generation by Friedrich and Peter Lürssen, claims to be at the forefront of the industry in implementing innovations and new technologies on its ships.

Therefore, it is no surprise that Lürssen is now building the first yacht with fuel cell technology for a pioneering and technology driven client. This new climate-neutral yacht project, which is likely to become an emergence into a new era, is known as »Alice«. Although Lürssen usually remains very discreet when it comes to yachts under construction, some details have already been revealed.

Core of this technological leap is a state-of-the-art fuel cell that flanks the conventional diesel generators. This innovative technology should allow the yacht to anchor emission-free or to cruise 1,000 miles at slow speed by using only the fuel cell for propulsion. Peter Lürssen states: »My great grandfather built the world's first motorboat, my dream is to be the first to build a yacht without a combustion engine.«

Since 2005 Lürssen has been involved in research projects aimed at using fuel cells on ships in order to advance sustainable shipbuilding. One example is the national research project PaX-cell together with Besecke, Carnival Maritime, DLR, DNV, EPEA, Freudenberg and Meyer Werft. The aim was the development and testing of a hybrid energy system with a new generation of PEM fuel cells for yachts and seagoing passenger vessels.

Meanwhile, Lürssen has set up an Innovation Laboratory to simulate and test the integration and operation of a Marine Hybrid Fuel Cell System. »We don't just want to use the latest technology on our yacht – we want to ad-

vance the status quo.« And in order to change things, you have to be active,« says Peter Lürssen.

Hydrogen from methanol

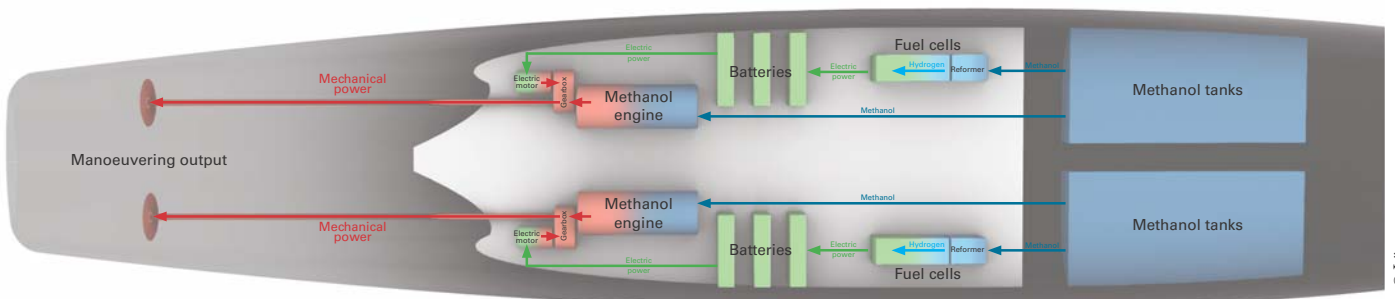
Under real life ambient conditions and with all required auxiliary systems this demonstration plant will help to bring fuel cells on board a yacht successfully. The shipyard has committed to a strategic partnership with Freudenberg, one of the leading experts for maritime fuel cells.

Lürssen's and Freudenberg's concept is a fuel cell driven by hydrogen which is continuously reformed from methanol. The choice of methanol rather than elemental hydrogen has been made due to its higher energy density, the simplicity of handling and easy world wide availability. But most important, methanol can be stored in structural tanks in the double bottom of a yacht in contrast to pressurized or liquefied hydrogen which requires valuable space above the tank top and extensive tank structures. For higher speed and energy demands, an additional methanol engine will be added.

Methanol is an important base material for the chemical industry and has been an option to be used as clean fuel for decades. When produced from renewable sources like by CO₂ capturing from the atmosphere, methanol, is completely climate-neutral. Due to the low dynamic capability of fuel cells the system layout and the



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combination with other energy converters and storages is the key for a successful installation.

Thanks to the modular construction the methanol fuel cell system can be adjusted to a customized yacht to keep space requirements and costs as low as possible and the total efficiency of the system as high as possible. Fuel cells cause almost no noise or vibrations, need only minor maintenance and are more efficient than diesel engines. Most important emissions like nitrogen oxides, sulphur oxides, soot and even CO₂ can be avoided when green methanol is used.

»The yacht, which is currently under construction, will be able to stay more than 15 days at anchor with the night time power supply being a zero emission mode. And the yacht can reach more than 1000 miles slow cruising with zero emission,« Peter Lürssen comments.

More energy savings

Furthermore, energy saving technologies such as waste heat recovery utilisations recover heat emissions for use within the HVAC system, for both heating and cooling-purposes. This is complemented by mirrored glass windows around the owner's deck where reflecting the heat serves for thermal insulation and reduces energy load of the air conditioning systems, according to Lürssen.

Parks and ponds transform the yacht's deck into a natural paradise, which when combined with the living walls in the interior, create a unique ecosystem on board. Teak is replaced by fast-growing and lightweight organically farmed wood that meets the high standards for yachts. *KF*

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