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Zero-Emission Shipping

FUELING ELECTRIFICATION

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The Koedood Marine Group in the Netherlands produces EU stage V type-approved diesel engines with ultra-low emissions. Following the development of their modern propulsion systems, the group's R&D department is already working on new approaches for eco-friendly shipping.

Bachmann talked to Sander Roosjen, R&D Manager at Koedood Marine Group, about sustainable propulsion concepts and different energy sources – and what is crucial for these concepts to become reality.

Sander Roosjen
R&D Manager,
Koedood Marine Group

Mr. Roosjen, after the development of the EU Stage V certified engines, which future-proof concepts are you addressing next?

We are working on different concepts. On the one hand, there is no one solution for all vessels. Additionally, various developments are currently taking place both rapidly and simultaneously.

Will diesel still play a role?

We won't get rid of diesel within the next decades. A large number of vessels will still use diesel engines in 2050 – hopefully equipped with exhaust after-treatment technology, of course. The energy requirements are so enormous, that it would be unfeasible to convert the global fleet to zero-emission technology in the near future. Take hydrogen for example: If every large vessel were to use fuel cell technology, then there currently wouldn't be enough renewable energy to create the required volumes of green hydrogen. There are also a lot of both economical and logistical questions to be answered when it comes to hydrogen storage concepts. The hydrogen value-chain is in its infancy and its many facets need to grow collaboratively and at the same rate.

We will need a mix of different energy sources. And we have no crystal ball to predict which will be the main fuel for the maritime industry in future. Therefore, we need to build a flexible foundation in order to make efficient use of future developments.

What could this foundation look like?

Our vision for the future is to provide a flexible platform with an electrical drive train. One thing is certain: Ship owners never regret the electrification of a vessel. When you use a power management system together with an electric engine, preferably a permanent magnet engine directly on DC, then you can modularly add or exchange energy-providing units as you go. That's a kind of plug-and-play power combination for your drive line. There are about 120 diesel-electric hybrid vessels equipped with Koedood technology already at sea in Europe. On this basis, you can use a diesel engine with an after-treatment system today, for example, and exchange it with a more future-proof technology such as a methanol-based engine or an ammonia fuel cell system in the future.

Which energy sources do you use for your current developments?

One of the new technologies we are focused on is methanol. It is a very potent option, especially for short sea vessels.

We are looking into methanol as a dual-fuel solution, primarily for the retrofit of inland marine vessels. It is the customers that want diesel as a backup, because the logistics and refueling possibilities with methanol are not yet consolidated. This solution can run 100 percent on diesel, and almost 100 percent on methanol. With normal loads, we can substitute diesel for methanol up to a rate of 97 %. The remaining diesel is only required for initial ignition.

We use a Bachmann controller for the normal operation of the engine and alarm systems. It is easy to couple with the technology we developed for the EU Stage V engine and also supports our machine learning und predictive maintenance ambitions.

Another technology we are working on is hydrogen fuel cells. Together with Nedstack, we are building marine-certified

300 kV systems. The data collection is very encompassing: We use pressure and temperature sensors in almost every piece of piping.

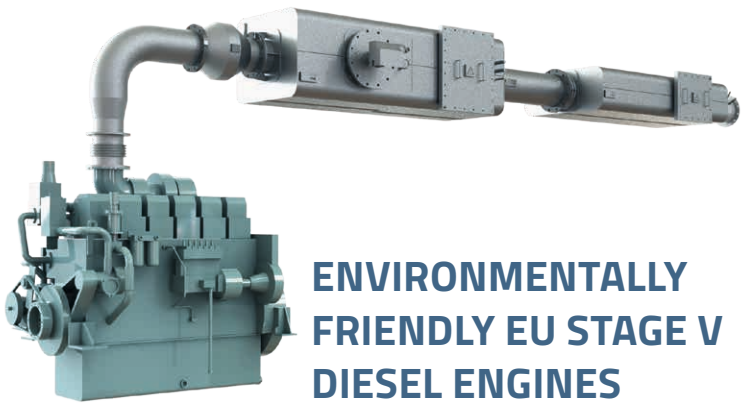
This sounds like a complex development. How do you stay efficient in this process?

We actually developed the control system separately from the Piping & Instrumentation Diagram by creating a digital twin. First, we worked out the control system on a conceptual scale in MATLAB® to control all the parameters and fine-tune the system. And then, we put sensors on the model to check it was operating within the desired boundaries.

With the Bachmann automation system, it was very simple to transfer this digital twin to an actual PLC automation platform. Connecting the IOs from the field site to the right points in the model was as easy as sending an email. So in the end, everything was fixed and tested in the digital twin, we just needed to confirm it in the field. This provided a great parallelization in the engineering process. I think it saved us about two or three months of programming work compared to a serial process.

The fuel cell system will be field-tested by the end of this year. By Christmas, the first fully zero-emission inland maritime vessel will set sail here in the Netherlands – on Hydrogen.

Thanks for the interview.



ENVIRONMENTALLY FRIENDLY EU STAGE V DIESEL ENGINES

The Koedood Marine Group of companies specialize in diesel engines and exhaust after-treatment systems, among other things. Together with Mitsubishi, the scientific institute TNO, and the type-approval authority RDW, Koedood developed KEES – the Koedood Engine & Emission System. The combination of diesel engine and after-treatment system is EU Stage V certified. With its low fuel consumption and emissions, KEES sets new standards in eco-friendly shipping.

According to Sander Roosjen, R&D Manager of Koedood, the combination of engine and after-treatment system required a large amount of automation, sensor, and actuation technology. In addition, the software needed to fulfill various requirements to comply with EU Stage V legislation.

Therefore, a robust, marine-certified, and very flexible engine automation platform was required. "It was important for us that this platform is able to grow with the wave of digitalization that we see. Therefore, we worked together with Bachmann not only during the selection and testing phase of the automation system, but also discussed the further development of new digital technologies we want to apply in our EU Stage V platform," said the R&D Manager.

One of Koedood und Bachmann's next co-developments is a remote platform, called 'fleet manager', to visualize every parameter and alarm from the range of vessel engines in the field. For Sander Roosjen, this will be the first step towards big data, enabling novel technologies such as machine learning and predictive maintenance.

One of the first applications of the Stage V engine are so-called River Drones, 10 semi-autonomous vessels, which are controlled from the shore in Antwerp. The 106-meter-long ships are each equipped with two Koedood Stage V engines, two 360-degree rotatable all-electric EQUADRIVE® pod drives, and one bow thruster from Verhaar Omega. Engine, pod drives, and bow thrusters are all controlled by a Bachmann automation system.

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