THE MAGAZINE WITH INSIGHT
BUSINESSFOCUS

WOODWARD L'ORANGE
MARINE INDUSTRY GOES GREEN

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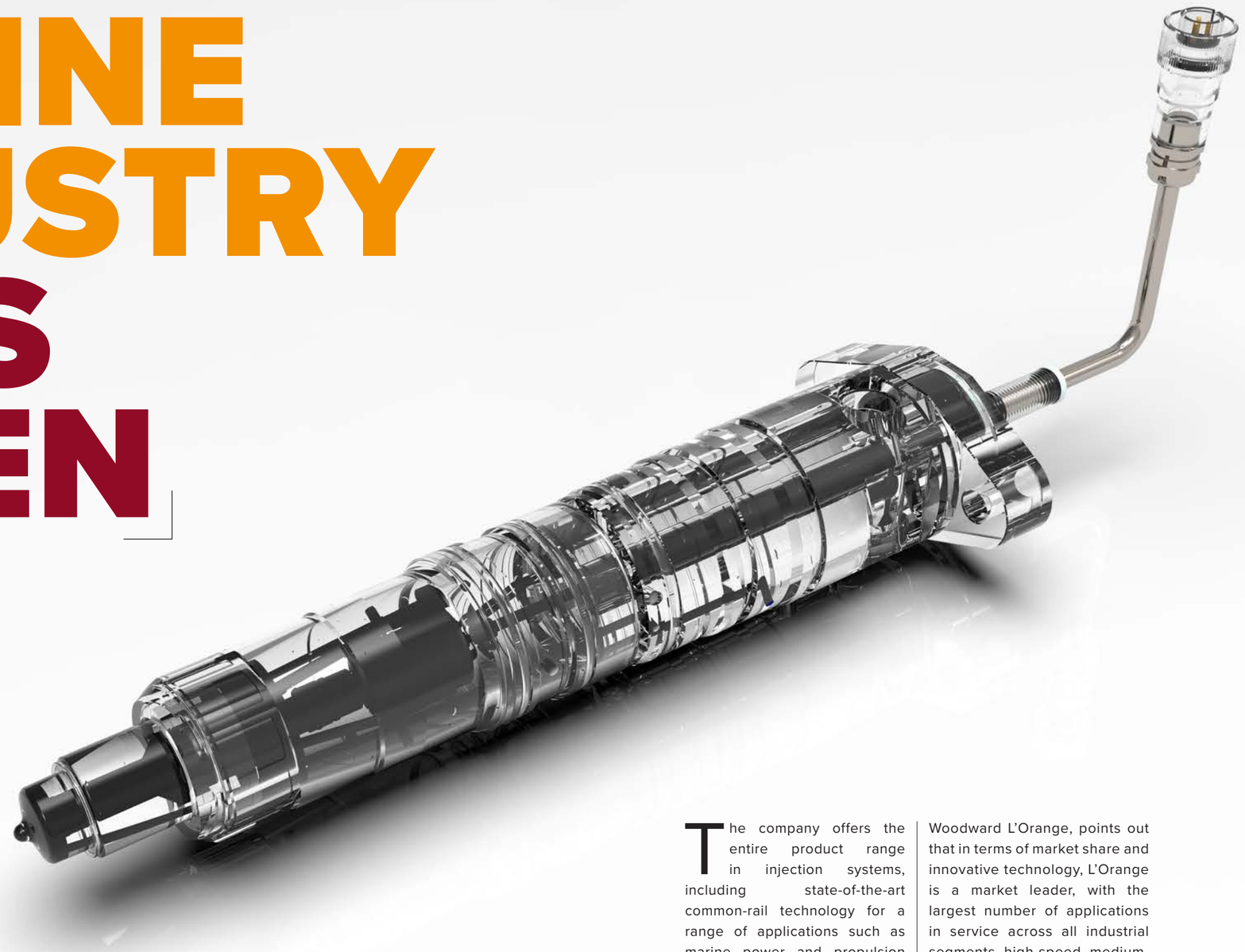
L'orange

WOODWARD L'ORANGE, A PIONEER IN STATE-OF-THE-ART INJECTION TECHNOLOGY, IS USING ITS INNOVATIVE STRENGTH TO MEET THE DEMAND FOR SUSTAINABLE SOLUTIONS.

MARINE INDUSTRY GOES GREEN

PROJECT MANAGED BY: DAVID TAVERNOR

Woodward L'Orange GmbH, a German engineering manufacturing company headquartered in Stuttgart, is a leading manufacturer of injection systems for diesel engines worldwide, currently employing some 1,400 people at its locations in Germany, the USA and China.



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Common Rail injector for 2-stroke applications: up to 5 injectors per cylinders either in pilot injection mode or in HFO main injection mode.

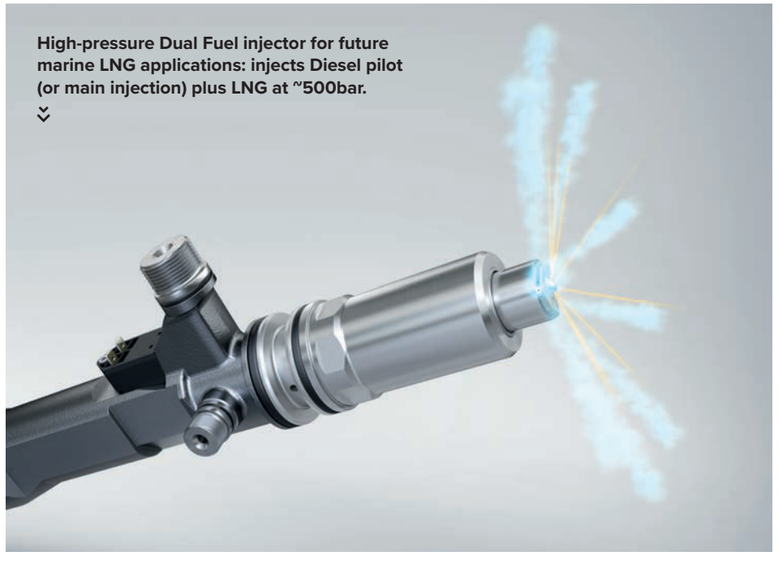
The company offers the entire product range in injection systems, including state-of-the-art common-rail technology for a range of applications such as marine power and propulsion systems, oil and gas processing, power generation, locomotives and special-application vehicles.

Dr Andreas Lingens, General Manager and Vice President, Woodward L'Orange, points out that in terms of market share and innovative technology, L'Orange is a market leader, with the largest number of applications in service across all industrial segments, high-speed, medium-speed, low-speed, within the 1 to 60 MW range.

L´Orange pioneered the evolution of common-rail technology with its world-first launch in 1997 of the S4000 MTU high-speed diesel engine. Today, L´Orange´s common-rail systems are used in all 3 engine categories, in high speed, medium and low speed. While common-rail technology is associated with diesel engines, it is also used to ignite the gas-air charge in dual-fuel marine and Powergen engines.

Reducing emissions and greenhouse gases (GHG) throughout all applications ranks among Woodward L'Orange's top priorities. Due to the very different types of application with their respective duty cycles and use cases, there is a variety of emissions legislation specific to each engine application and each region of the world. The marine engine legislation mandated by the IMO (International Maritime Organization) has the biggest environmental impact due to its world-wide span and its relevance for all 3 engine categories.

The latest amendments coming into force in 2020 and 2021 to reduce marine engine sulphur oxide and nitrogen oxide emissions, respectively, pushed for significant technology evolution in fuel systems and exhaust after-treatment. In addition, the IMO has committed to decreasing the marine industry's total emissions of climate-damaging gases by 50% by 2050 (versus 2008). Considering the long life of vessels (typically 30 years of operation), the maritime industry and its partners are taking rapid action to develop relevant solutions. »



High-pressure Dual Fuel injector for future marine LNG applications: injects Diesel pilot (or main injection) plus LNG at ~500bar.

GREEN DEVELOPMENT

The IMO´s ambitious GHG reduction target is already driving new propulsion system technology and new sustainable fuel solutions. While electrification and hybridization offer opportunities in short-distance applications, other solutions are required especially in the area of international sea traffic. These applications require liquid fuels with high volumetric energy density to transport goods and passengers at reasonable transport rates. There are significant opportunities in the carbon content of the fuel and in the engine technology to inject and to burn such fuels.

The first stage of fuel decarbonization in maritime operation can already be seen. Liquid natural gas, stored at -163°C onboard a growing number of vessel types (LNG tankers, cruise ships, ferries, container vessels), offers an immediate opportunity to reduce CO2 emissions by 25% Furthermore, dual-fuel technology significantly reduces pollutant emissions (particulates and sulphur oxides by over 90%, nitrogen oxides by over 50%). Dual-fuel marine engines burn natural gas (methane) as their main fuel (instead of heavy oil) and employ a diesel fuel pilot injection (1-2% of the energy) to ignite the gas in the combustion chamber. As well as the gas admission valves and controls, Woodward L´Orange supplies the liquid fuel system to the major marine engine builders.

The total effect of GHG-reduction, however, cannot fully reach the theoretical 25% improvement natural gas offers over diesel (HFO or MGO). Methane slip into the exhaust system has a high compensating effect due to its high global warming potential. This is relevant for 4-stroke engines, but much less so for 2-stroke engines.

Woodward L´Orange has taken the detrimental effect of methane slip seriously and for several years has been producing so-called high-pressure direct injection systems for LNG. Methane emissions can be almost entirely eliminated by injecting liquefied natural gas (LNG) into the combustion chamber – reducing the total GHG emission by 25%. The latest Woodward L'Orange HPDI generation currently under development injects LNG into the combustion chamber

HPDF injector nozzle with 1 central Diesel needle and 3 needles for the main fuel.

at 500 bars. Diesel, as the pilot injection/ignition fuel, is injected into the combustion chamber at up to 2200 bar. This new dual-fuel injector generation also allows diesel operation when gas is unavailable.

While some 25% GHG reduction, combined with near-elimination of particulates, sulphur oxides, nitrogen oxides, is available today, the route to near-zero emission is under development. The goal of climate neutrality for marine propulsion systems can be achieved with so-called PtX fuels, which use sustainably produced with hydrogen as a starting point. Ammonia and methanol are especially well suited to marine applications since they can be transported in liquid form at moderate pressures and their production process is relatively low in energy consumption. Woodward L'Orange is already developing such technology with the first series of applications coming in the second half of the decade.

"Our dual-fuel technology allows the transition from diesel to gas, a significant improvement in terms of GHG and pollutant emissions, and with the aid of carbon-neutral ››

fuels is the route towards near-zero-emissions. We can see demand increasing across all 3 marine engine categories. We have been a market leader in this segment and see our dual-fuel technology as an important growth area of our business," says Dr Lingens.

LOOKING AHEAD

The innovative focus continues to be a strong competitive factor and L´Orange´s diesel technology combined with Woodward´s innovative gas and control systems is a winning factor towards green marine propulsion systems. With the combined scope, the company is now able to deliver complete fuel systems including engine controls. "Innovation will carry us into the future. Our standard level of investment in R&D is around 7% of revenues and seeking new technologies with an increased focus on sustainability will continue to be a core part of our business development," says Dr Lingens.

"WITH THE HELP OF P2X-FUELS, FUTURE MARITIME PROPULSION SYSTEMS EMIT NEAR-ZERO POLLUTANTS AND ARE GHG-NEUTRAL.
OUR CURRENT DUAL-FUEL SOLUTIONS - USING LOWER-CARBON FUELS SUCH AS LNG OR LPG - DEMONSTRATE A SIGNIFICANT PROGRESSION DOWN THAT PATH ALREADY TODAY."

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