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ADAPTING TO EVOLVING ENGINE DEMANDS

As emissions regulations drive a transformation in the technical demands of the shipping industry, WinGD is mapping its view of future engine design. **Dominik Schneiter**, vice president, research and development, outlines the company's priorities

While 2016 and the first several months of last year were slow in terms of orders and turnover, they were marked by some key decisions that will influence the direction of engine development over the next few years. Chief among them was the IMO's decision to press ahead with the global sulphur cap from 2020.

"The sulphur cap has triggered big discussions and many projects have kicked off exploring new technology and new fuels," says Schneiter. In the interview below, he discusses how recent market developments have convinced the company that its emissions reduction and digitalisation strategies place it on firm footing for the future.

Q You've made some big leaps developing the installed base of your X-DF dual-fuel engines in the past year or so, with the first Aframax tankers and ultra large containership orders, and the first large LNG carrier references in service. How important have those steps been?

A We have reached double figures now and will reach 20 X-DF engines in service soon. The orderbook will reach 100 vessels any time now, so it has been quite a fast ramp up.

The order from CMA CGM for the biggest engines *[the 12-cylinder, 920mm bore X92DF - Ed]* was ground-breaking because a lot of people were saying that you would never convince the container trade to change fuels. We have a good relationship with CMA CGM and have been discussing possibilities for years, but until the firm order last year, it was back and forth between traditional HFO plant plus scrubbers and X-DF propulsion. The challenge is now to build the engines. The timeframe is very ambitious, but we are confident that we can deliver.

These containerships are the first gas-fuelled vessels on a global trade and the Aframaxes ordered by AET and Sovcomflot are the first for the tramp trade. Now ports must start to invest in infrastructure. This will push LNG into the market a lot and there are already signals that other ship operators are considering the same change.

Q What is your perspective on alternative fuels beyond LNG?

A We are now looking at the substitutes for LNG that can use the same technology. We have just demonstrated a fuel mix using liquid volatile organic compounds (VOC) on the RT-flex 50DF test engine in Trieste. We combined up to 20% VOC to LNG and demonstrated the running engine to customers who contracted for that. It's a viable option and something that could entice crude oil carriers to switch to LNG propulsion.

Under the HERCULES 2 project funded by the EU's Horizon 2020 initiative we are currently looking at ethanol as fuel. We have been running this in our test rigs. We're also studying lignin, which is a kind of heavy fuel oil substitute from biofuel. You need to heat it to reach the right viscosity, you need to filter it because there are some residuals, and if you store it incorrectly it turns into a kind of old butter. Under current guidelines, you would need a separate fuel system to avoid compatibility problems. Otherwise you might have issues with paraffinic wax blocking supply lines.

■ **"Heavy fuel oil was the standard for the last 30 years, and the new standard in our eyes should be LNG"**

If a fuel is stable and does not oxidise then it can be burned in an engine. There may be some effects on combustion, injection equipment, materials and tribology, but we can burn it. However we believe that the industry should concentrate on one or as few fuels as possible. The more fuel variety we have the greater the technical challenges we face. HFO was the standard for the last 30 years, and the new standard in our eyes should be LNG.

Q What steps is WinGD taking to prepare for the onset of hybrid propulsion in larger vessels?

A The equipment is available. You can find energy storage of 5MWh capacity, for example, in a 20-foot container and the power electronics and controls are available. The issue is that the capex is still too high. We need to monitor the development of storage prices. There will be a pivot point where people will start looking and we need to be ready before then.

The key to hybridisation is in the software. The two-stroke engine provides for a lot of margin, for example for when the water is shallow or rough. If you have an electrical boost mode for these situations, you can reduce that margin and install a smaller engine, which is good for CO2 emissions. But then you need a powerful management system that can balance the engine with the energy storage and react to changing boundary conditions in a split second. That is our challenge.

Q You recently completed the development of the WinGD Integrated Digital Expert (WiDE) engine diagnostics platform with partners Propulsion Analytics and Enamor. Will the roll out of remote engine diagnostics be helpful in developing your hybridisation strategy for two-stroke engines?

A The more data we can get from vessels about operating conditions and the influence of sailing conditions, the better we can prepare for these upcoming challenges. We have pilot operations running in the Baltic Sea and the third and fourth installations are now being prepared. Since 1 January 2018, all our newly contracted engines will have these systems from delivery.

We are also undertaking to retrofit WiDE for all our X-DF engines in service. We see huge benefits to our LNG technology from gaining much quicker feedback and experience. It will allow us to analyse what's happening on board and to understand the boundary conditions we need to consider for the next design phase. We see huge potential for remote diagnostics to advance our dual-fuel technology.

Q Meanwhile, what changes have you made to the 'conventional' X-series of two-stroke engines?

A We haven't changed the portfolio fundamentals, but we have introduced an upgrade across the portfolio. In our new range you will see the X62B, 72B and 92B. The 'B' version is an upgrade in power density, so that out of the same engine we get a higher power output and with a good derating strategy you can get better fuel consumption for the same power.

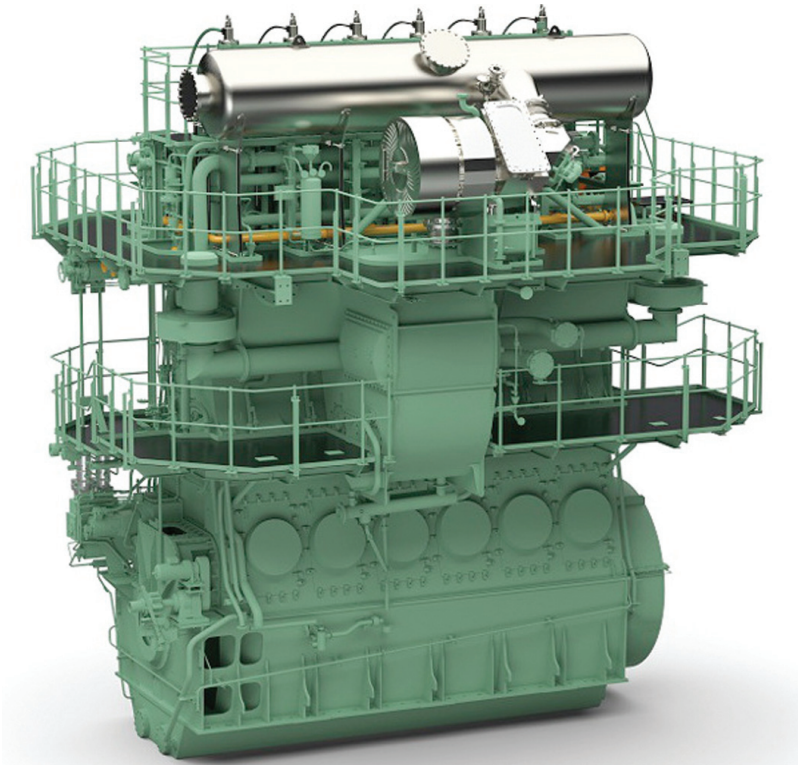
The structure of our dual-fuel engines - including the bearing layout and the combustion chamber - was adapted for higher firing pressures. This design can also be used on the diesel version for higher firing pressure and therefore more torque. If you look back over the last hundred years of engine design improvements it is always the firing pressure and mean effective pressure that have been increased, and with that power density and fuel consumption are improved.

Q WinGD recently announced a collaboration with Hyundai Heavy Industries to integrate engine diagnostics into the shipbuilder's wider smart ship systems. Do you foresee more smart system integration coming with other shipbuilders?

A Not only with shipbuilders but also other high-level system designers, such as ABB Agile or Kongsberg Kognifai. If they are interested in integrating us we are interested to do so.

We see our core as the engine. That means having proper engine performance monitoring, going towards predictive maintenance and giving the right data to the engine operators onboard or ashore, to make sure that one of their most valuable assets is performing - or to give early indication if it is not.

That's our focus and the integration into other systems is a consequence. The main engine is usually the main energy consumer and a key factor in opex. The more open we are, the better chance that performance monitoring systems will work well.



A mix of gas and VOC was tested on WinGD's RT-Flex 50DF dual-fuel demonstrator engine in Trieste

Q The IMO has agreed its initial greenhouse gas reduction strategy. As an engine developer, what are your views on how reductions can be achieved, and how do you anticipate it will change your business?

A Reducing CO2 emissions is a challenge that can be addressed in several ways, one of which is to make the engine more efficient. But you will never reach a zero-emission vessel that way. Carbon-neutral fuels and hybridisation are other possibilities. I think the solution will be to reduce the size of the combustion engine in the vessel, to reduce CO2 emissions with some other supporting devices and to achieve the rest, as much as possible, by using CO2-neutral fuels.

I don't think the combustion engine will be replaced on a deep-sea tanker or a ship trading between Asia and Europe or America, for example. The distances are too far, you would have to store terawatt-hours of electrical power in a battery system, which would be heavier than the entire ship. This is unrealistic given the current technical possibilities, but I am sure the industry will develop in that direction.

I am sure too that there will be further restrictions to the Energy Efficient Design Index after 2025. I hope it will not be 5% every five years as it has been, as this would be a major challenge. Having said that, increasing restrictions always drive technical achievements, which is where we are strong. I don't see increasing restrictions as a risk, it's an opportunity around the combustion engine.

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