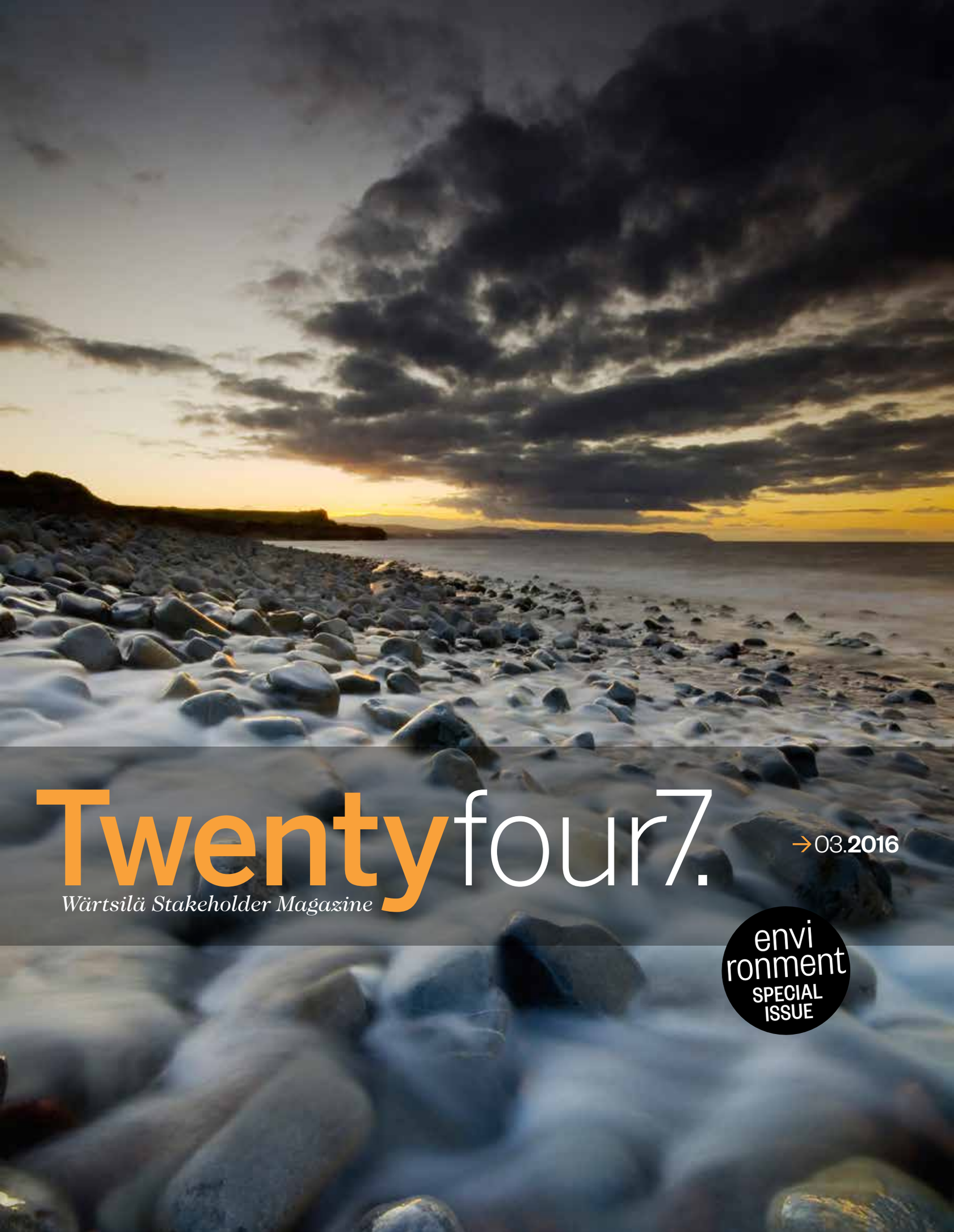

Twenty four7.

Wärtsilä Stakeholder Magazine

→03.**2016**

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Wärtsilä Stakeholder Magazine

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Sign off

in detail

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Time for a sea change

CHANGING HOW WE DO THINGS is rarely an easy switch. Whether it's taking the stairs instead of the elevator, eating more vegetables, or watching less television, our mere desire to improve our lives is rarely enough to make change happen.

To be willing to endure the discomforts that any change brings, we have to believe that we *need* to change. If change is not an urgent priority, nothing much will happen. Also, while motivation gets us started, willingness to make changes is not enough if we do not have the means or support to carry them out.

These struggles are just as apparent – if not more so – within companies and entire industries when they attempt a structural or operational change. Improving environmental efficiency may be one of the most radical kinds of changes, depending on the industry, because it may require practices that are far removed from the current ones, and it may demand change along the value chain, which only magnifies the challenge.

Everyone knows that a clean environment is important, but finding that desire or need to get started can be a quantum leap. Some companies may opt to do the right thing, especially when influential people within the organisation lead the change. Others are motivated to become more environmentally efficient because of social pressure from industry peers or current and future customers. And often the tightening environmental legislation acts as the main trigger to take action.

But environmental efficiency can also be good for business. In this day and age the consumers have all the power, and many prefer the greenest available option. This ultimately has an impact on all industries. The good news is that there are many solutions already on the market to help companies remain profitable or even take a competitive advantage while decreasing their carbon footprint.

For example, our Smart Power Generation power plants help maximise the use of renewables, and our Flexicycle plants generate even more electricity by capturing excess exhaust heat (see p. 62). Momentum toward adopting greener practices increases as technology improves, which is the case in the rapidly-growing solar industry.

In shipping, proactive companies are already installing technologies that can save fuel and reduce emissions, such as the latest in energy-efficient propulsive devices (p. 66). Others, such as BC Ferries and DEME, are switching over to liquefied natural gas (LNG) as a clean alternative fuel. On page 54, you can read about new, ultra-efficient designs for fishing vessels, which incorporate the latest Wärtsilä technologies in engine, battery and gear-box designs. And, of course, keeping waters clean and clear means rigorous management of waste and ballast water with the right technologies (p. 38).

The momentum towards greater efficiency and lower emissions is unstoppable. The real choice is how to make the most out of this megatrend. No matter what the future brings, Wärtsilä will be there to help find solutions to support those changes. When it comes to protecting the environment, we're all in this together.

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You can operate **wherever** you want

THIS ENSURES ENVIRONMENTAL COMPLIANCE

WÄRTSILÄ HAS THE MOST COMPLETE RANGE OF ENVIRONMENTAL SOLUTIONS IN THE WORLD

WÄRTSILÄ CONNECTS THE DOTS

The modern world demands smarter shipping. Wärtsilä has the most complete offering of marine solutions in the world. From dual fuel engines to environmental solutions, we provide all the products, solutions and services you need. Let Wärtsilä connect the dots that make your life both easier and more profitable.

WÄRTSILÄ

*around the globe

NEWS & ONLINE | GLOCAL WATCH | WORDS & NUMBERS | TRENDS & SCENARIOS | CORPORATE CITIZENSHIP

PHOTO: iSTOCK

A more frugal ferry

Every summer we can rent a cottage in the Isle of Wight if it's not too dear

REFERENCED IN FAMOUS FILMS, literature and music – like the Beatles' "When I'm 64" – the Isle of Wight has been a popular seaside holiday destination ever since Queen Victoria had her summer home there. However, its draw in the present day is more for its walking and cycling holidays and the annual Walking Festival.

The Isle of Wight is the largest and second-most populous island in England. Travel to and from the island, about 5 miles (8 km) off the mainland in the English Channel, has required a ferry service for over a century. But now even the ferry transport is evolving.

A new ferry being built for the local operator Wightlink will be the most environmentally sustainable vessel ever on this route, thanks to a comprehensive range of modern Wärtsilä equipment and systems. In addition to conventional fuel, the new vessel will be the first ferry to use Wärtsilä hybrid battery technology to improve efficiency, reduce the exhaust emissions and lower the noise level.

The vessel will feature two fixed vehicle decks to hold the equivalent of 178 cars, and it will have space for more than 1000 passengers. Delivery of the Wärtsilä equipment is scheduled to commence in spring 2017, and the vessel will enter service in 2018.

[AROUND THE GLOBE]

News

SUSTAINABILITY BENCHMARKS

Wärtsilä has been selected to be included in the Dow Jones Sustainability Indices (DJSI), both in the DJSI World and DJSI Europe versions.

The Dow Jones Sustainability Indices are a family of indices evaluating the sustainability performance of the largest companies listed on the Dow Jones Global Total Stock Market Index. As the longest-running global sustainability benchmarks worldwide, they are key reference points in sustainability investing for investors and companies alike.

In addition, starting September 2016, Wärtsilä is included in the Ethibel PIONEER Investment Register, as well as reconfirmed for inclusion in the Ethibel EXCELLENCE Investment Register. This selection by Forum ETHIBEL indicates that the company can be qualified as a sector leader in terms of Corporate Social Responsibility (CSR).

"The selection into the Ethibel PIONEER Investment Register finally places us in the group of sector leaders in CSR. Once again, we will use this external recognition as additional motivation to continue our pursuit for ever more sustainable solutions and services as well as for good corporate citizenship," says **Marko Vainikka**, Director, Corporate Relations and Sustainability.

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EXCITEMENT
RESPECT AND TRUST

ENERGY
MAKE THINGS HAPPEN

DO THINGS BETTER
EXCELLENCE

Wärtsilä
GLOCAL
WATCH

INDONESIA:
The Asian Power Awards announced the winner for the best dual-fuel power plant of the year, PT Indonesia Power, with their 200 MW power plant PLTDG Pesanggaran Bali. The project was executed in a consortium with Wärtsilä as the lead partner, together with PT Pembangunan Perumahan (Persero) Tbk (PT PP), one of Indonesia's largest construction contractors. The annual award recognises groundbreaking projects and trailblazing initiatives in the power sector in Asia. According to the jury, the largest engine-based power plant in Indonesia stood out among the nominations with its large nominal output.

DENMARK:
A new 158-metre-long car and passenger ferry being built for Danish operator Mols-Linien will be powered by two 8-cylinder Wärtsilä 31 main engines. The engines are scheduled to be delivered to the Rauma Marine Constructions shipyard in July 2017, and the ship is due to enter into service in summer 2018. The ferry will sail in Danish waters between Rønne, on the island of Bornholm, and Køge, and between Rønne and Sassnitz. The Wärtsilä 31 was introduced to the market in 2015 and has been recognised by Guinness World Records as the world's most efficient 4-stroke diesel engine. This high efficiency was cited as a key consideration in the award of this contract to Wärtsilä.

BRAZIL:
Wärtsilä has signed a contract with Imetame Energia to supply a 28 MW natural gas power plant to UTE Prosperidade I in Brazil. The power plant will be equipped with Wärtsilä 34SG engines operating on the "Gas to Wire" concept. This means that natural gas is converted to electric power close to the remote gas fields and transmitted to urban areas via transmission lines. It is challenging to monetise gas in Brazil, as the pipeline network is not yet very developed and the state controls the sale of gas concessions. Wärtsilä suggested thermal generation as a way to monetise the gas and add value to the project through the sale of electricity.

HAPPINESS, ECONOMY AND SOCIETY PUT TOGETHER – AND MEASURED

TEXT: ANNA GUSTAFSSON **PHOTO:** SHUTTERSTOCK

For years we have thought that wealthy Western countries produce the happiest people. But when compared with the amount of our planet´s resources used to achieve that well-being, those Western countries do not measure up so well. Happy Planet Index assesses happiness, economy and society collectively. And the results are interesting.

THERE ARE SEVERAL WAYS to evaluate the development and progress of a nation. While many rankings are now in existence, each one has the same countries, with very little variation, competing for the top position. But there is a study that takes a completely new approach – with new results.

The Happy Planet Index, which published its most recent ranking this summer, takes a look at health and happiness of people, but compares them against sustainability and the country´s ecological footprint. So countries where people have long, healthy and happy lives, but use less of the planet´s resources to achieve that goal, rise up in the list. Interestingly, the top spots are not taken by the usual wealthy Western countries.

For many years, Costa Rica has been number one, as also in the most recent results for 2016. The countries in the top 10 are mostly from South America and the Asian Pacific. The first European country, Norway, is found in the 12th position. Finland is ranked number 37.

DR LUCIE MIDDLEMISS IS a researcher and lecturer on sustainability at the University of Leeds' School of Earth and Environment. In her research, she concentrates on the boundary between social and environmental issues. She welcomes new ways to measure a country´s development.

"I definitely think one measure, like looking at the GDP, is not enough, to get a clear picture of what is happening in a country. You need a range of measurements to reliably study human development or sustainable development. So in this sense, the Happy Planet Index is an improvement, as it does not look only at economic development, which is the approach that most nations take."

However, Dr Middlemiss believes solving environmental issues does not necessarily make people happy.

"I find the association of environmental issues and happiness problematic. We in rich countries can choose to put happiness as our life objective, but the reality of life for many others is more brutal than that," she explains.

This is why the Happy Planet Index uses several factors in its calculations. It derives results for happiness through a Gallup World Poll, where people are asked how satisfied they are in general with their lives, and outcomes for life expectancy are based on data collected by the United Nations. And for the ecological footprint, data is collected from the Global Footprint Network.

WHILE THE HAPPY PLANET Index takes into consideration the inequality of outcome, it does not measure how well human rights are actualised in each country. Dr Middlemiss perceives this as an issue.

"The problem with looking at developing countries is that we often have a patronising attitude. I see it with my students, who after visiting a developing country come back saying how friendly and happy everyone was, despite being poor," she observes.

"But if you look at countries like Mexico or Colombia that score high on the Happy Planet Index, they have lots of social problems. For example, Bangladesh, which is also in the top 10, has a massive poverty issue. You need to think of a range of things that a country would need to be a success story," she adds.

One of the upsides is to look at the growth of enterprises in developing countries (listed in the Happy Planet Index) that are progressing economically. As companies conducting businesses in a sustainable way can have a big impact on the overall development, well-being and happiness of people in a given country, the Happy Planet Index's idea to expand the measures of well-being is a welcome change.

[WORDS & NUMBERS] USEFUL DEFINITIONS AND NUMBERS OF INTEREST.

GREEN ACCOUNTING

is a type of accounting that factors environmental costs into the financial results of operations. The practice aims to help companies understand the relationship between traditional economic goals and environmental goals.

ANGLE OF INCIDENCE

is the angle at which sunlight strikes the surface of the solar panel relative to the perpendicular. The most efficient incident angle for solar power generation is 90 degrees.

1 zettabyte

In the year 2016, the world will use a zettabyte of data. That's one sextillion bytes – or one trillion gigabytes. It has been estimated that around 90% of all the data in the world has been created in the past two years.

[TRENDS & SCENARIOS] FUTURE PERSPECTIVES.

The walls come alive

Plants are beautiful and beneficial – but in urban environments, there may not be enough space for them. That is, unless you grow your plants vertically.

Vertical gardens are becoming increasingly popular across the globe. In big cities, they can be used to regulate air temperature and pollution and even reduce local flooding.

There are benefits from plant walls indoors, too. According to Green Fortune, one of the companies providing plant walls for office and commercial spaces, a plant wall is not only pretty to look at, but it also can reduce noise and improve air quality.

FROM SCRAP TO SCHOOLS IN ZAMBIA

[CORPORATE CITIZENSHIP]

Wärtsilä employees at a power plant construction site in Zambia are donating their leftover timber to a local orphanage. In this way, they are helping not only the community but also the environment.

A LANDLOCKED COUNTRY IN southern Africa, Zambia ranks as one of the poorest nations in the world. It has a per capita GDP of less than USD 1400 – a number that stands in stark contrast with countries such as Finland with USD 41,000 or the United States with 55,000. Although social indicators such as life expectancy and infant mortality rates are slowly improving in Zambia, major drains on government resources include high population growth and the prevalence of HIV-AIDS, which results in spiralling medical costs, growing numbers of street children and low worker productivity.

Filipe Mocito is a Wärtsilä employee currently based in the Zambian city of Ndola. He is the Site Engineer for the Ndola Phase II extension; an Engineering, Procurement and Construction (EPC) project to develop a 55 MW heavy fuel oil power plant consisting of six Wärtsilä 20V32TS engines that is scheduled to be fully operational next February. He recalls that, within a few days of arriving in Ndola, he and his colleagues began to understand the devastating effect that the AIDS epidemic has had on the local community.

"In the last decade or so, Zambia, along with most of Africa, has suffered horrifically from the impact of HIV-AIDS. Perhaps most shockingly, the disease has created an entire generation of orphans," he explains.

MOCITO CONTACTED THE OASIS Village Trust – a local orphanage that provides a secure environment for orphaned and vulnerable children, giving them a home, as well as providing for their educational, physical, spiritual and medical needs – to enquire about their requirements.

"We asked if they'd have any use for our leftover packaging materials that would otherwise just have gone to waste," he recalls.

In August, the Wärtsilä Ndola Phase II project started donating timber to Oasis Village. So far, it has been used to start building a new classroom, with an additional two classrooms in the works for the coming months. The wood will also be used to build storage space, tables and chairs. Donations are set to continue until the end of the project, as well as during the demobilisation phase.

"We're recycling material that might otherwise have ended up on a dump site or simply been incinerated," says Mocito, adding that timber provides an optimal solution for the safe transportation of Wärtsilä's construction material to its sites around the world.

"By reusing this timber, we're not only helping the local community but also reducing our environmental footprint," he continues.

IN ADDITION TO OASIS VILLAGE, some timber has also been donated to a local village near the site, where it is being used for cooking fires and minor repairs. In this way, Wärtsilä is recycling close to 100% of the waste timber from its Ndola site.

Mocito says that his experience in Ndola has made him understand, more clearly than ever, the importance of supporting charitable institutions and organisations.

"An organisation like Oasis Village has the experience and expertise required to make correct use of the donations, as in this particular case with the orphan community in Ndola," he says.

He also believes that Wärtsilä's support of the Oasis Village Trust, and other similar initiatives, stands to have a positive impact on the perception of Wärtsilä as a company.

"Being involved in activities such as these, wherever we may be in the world, contributes to establishing Wärtsilä's reputation as a conscious company that is concerned with social responsibility and willing to help develop and support local communities and the lives of the people in them," he says.

"BY REUSING THIS TIMBER, WE'RE NOT ONLY HELPING THE LOCAL COMMUNITY BUT ALSO REDUCING OUR ENVIRONMENTAL FOOTPRINT."

TEXT: ISABELLE KLIGER **PHOTO:** WÄRTSILÄ

Brace for an energy revolution

THE ENERGY INDUSTRY IS HAVING its 'Uber' moment. The rise of non-traditional energy providers and the transformation of consumers into prosumers are influencing market dynamics in an unprecedented manner. As renewables (at competitive prices) will start to become the baseload for energy in some geographies, the need to balance the grid is more pronounced now than ever.

But energy storage is not a new business. It has been a big industry for a very long time. The changing energy mix and technological and digital advancements over the past few years have accelerated the growth of this business. One of its main drivers is an expected drop in prices of lithium-ion battery technology, which is due to the growing popularity of electric cars. Storage systems support renewable intermittent energies, especially solar and wind, by standing in for the times when there is no sun or wind.

We at Wärtsilä perceive our movement towards renewables as a natural one. Our hybrid smart power generation technology is an off-the-shelf solution that can boost penetration of renewables. We aim to expand the solar business proactively with our current customers, and we are constantly exploring opportunities within the energy storage business.

Despite being a newcomer in renewables, we are aware of areas that need immediate attention. First, we need to design the 'right' business model. Secondly we need to sharpen our solutions and make them as competitive as we can. Customers are becoming the centre of the business and this will mean a change not only for us, but also for utility companies. They have been running their businesses in a "business as usual" way for decades and will now have to shift to being a service company (just as land-based phone companies did when the mobile phone business model came into being).

The emergence of new services and disruptive business models will take a stake in the energy value chain and reshape the industry globally. We are bracing for an energy revolution.

IÑIGO VIANI
Vice President, Renewables and Storage, Energy Solutions

RENEWABLES ARE HERE TO STAY. BUT FOR THEM TO SUCCEED WITH ENERGY STORAGE, THE SOLUTION HAS TO BE MADE AVAILABLE AT COMPETITIVE PRICES.

PHOTO: TOMI PARKKONEN

TEXT ASHA GOPALKRISHNAN **PHOTO:** ATTE PALOMÄKI & WÄRTSILÄ

LEAVING A MARK IN RWANDA

Imagine a quiet lake in the East African country of Rwanda with toxic gases trapped below the surface of its calm water. If ignored, the gases could lead to a catastrophe for the people and environment at large. Sounds like the storyline of a Hollywood thriller, doesn't it? Except the threat is very real. Yet it is one that is being turned into an opportunity through Project KivuWatt. Read on to see how the project at Lake Kivu is setting the stage for environmental and economic development in Rwanda.

Describing the seemingly serene lake with an analogy, Jarmo Gummerus explains, "It's like a soda bottle. You tap it when the pressure in the cap is higher than the pressure of the gas, which stays in the bottom, and you cap it. But if you keep adding the gas, it'll blow up the cap."

The Wärtsilä team George Oywer, Joost Bos, Atte Palomäki and Edze-Jan Kroneman on the long and windy road to Lake Kivu for the power plant inauguration. Photo: Heidi Glück.

The engines revved. **Jarmo Gummerus** had waited for over a decade to hear this sound. It marked the beginning of the much-awaited KivuWatt project, located at Lake Kivu (a.k.a. "the killer lake") in Kibuye, Rwanda. Gummerus, Country Manager with U.S. energy firm ContourGlobal, has seen this project grow from an idea to a full-fledged operation.

The USD 200 million project, owned by ContourGlobal and executed in cooperation with Wärtsilä, is expected to add 26 MW of generating capacity in its first phase (ongoing now) and eventually scale up to 100 MW in the coming years. In a developed country, the current 25 MW would provide enough energy for 45,000 people. But in largely rural Rwanda, it is already enough to radically transform livelihoods.

A quick look at Rwanda's power scenario will tell you why this project could mean big change for the country. Almost 80% of Rwanda's 12 million people lack a connection to the electricity grid. The ones who have access to power pay a high price for it because nearly a third of the country's power is generated using imported diesel and heavy fuel oil that arrive (by truck) from Kenya and Tanzania. According to the World Bank, Rwandan companies pay an average of USD 24 cents per kilowatt-hour, compared with 15 cents in Kenya and 17 cents in Uganda. The average industrial user in the United States pays less than seven cents.

This gap can be bridged if power is generated within the country using available resources. Take the case of Lake Kivu, which has high concentrations of methane and carbon dioxide gases trapped under heavy water. If left untapped, the rising methane levels could eventually cause the lake to explode (known as lake overturn or limnic eruption), with disastrous implications for people living in the surrounding areas and the whole environment.

"It's like a soda bottle. You tap it when the pressure in the cap is higher than the pressure of the gas, which stays in the bottom, and you cap it. But if you keep adding the gas, it'll blow up the cap," says Gummerus, using an analogy.

Project KivuWatt aims to extract the toxic methane gas from the depths of the lake to produce electricity. It not only spells economic benefits but also maintains ecological balance. "By taking out the methane, we are reducing the gas pressure and making the lake safer," says Gummerus. This is valuable given the lake's unusual yet unique geochemistry.

THE PROCESS EXPLAINED

Wondering how it is done? Gummerus explains the process adopted by ContourGlobal, which is in charge of the gas extraction. First, water is drawn from 350 metres below the surface by a special 3000-tonne barge anchored 13 kilometres from Lake Kivu's shoreline. Then, as the water rises and gases bubble out, it is channelled through a subsurface horizontal chamber, called a separator. From there, the gas is siphoned off for cleaning while the degassed water is injected back into the lake to maintain the ecosystem. The end product, a gas comprising roughly 85% methane is then pressurised and sent to a power plant, run by Wärtsilä, onshore.

"The gas engine we have can burn methane," says **Ulf Strandback**, Senior Project Manager, Wärtsilä. "What's special is, here we have CO_2 also, and the mix of methane and CO_2 and how low we can go on the methane percentage is where our engine excels. We have our own lab and can test mixes of gases," Strandback explains.

"For Wärtsilä, it's almost like an ordinary gas power plant, but the quality of the gas is our responsibility," Gummerus points out. He acknowledges the limitations in their pipelines, though. "It's a 13.5-km pipeline from the production part to the

"HOW LOW WE CAN GO ON THE METHANE PERCENTAGE IS WHERE OUR ENGINE EXCELS."

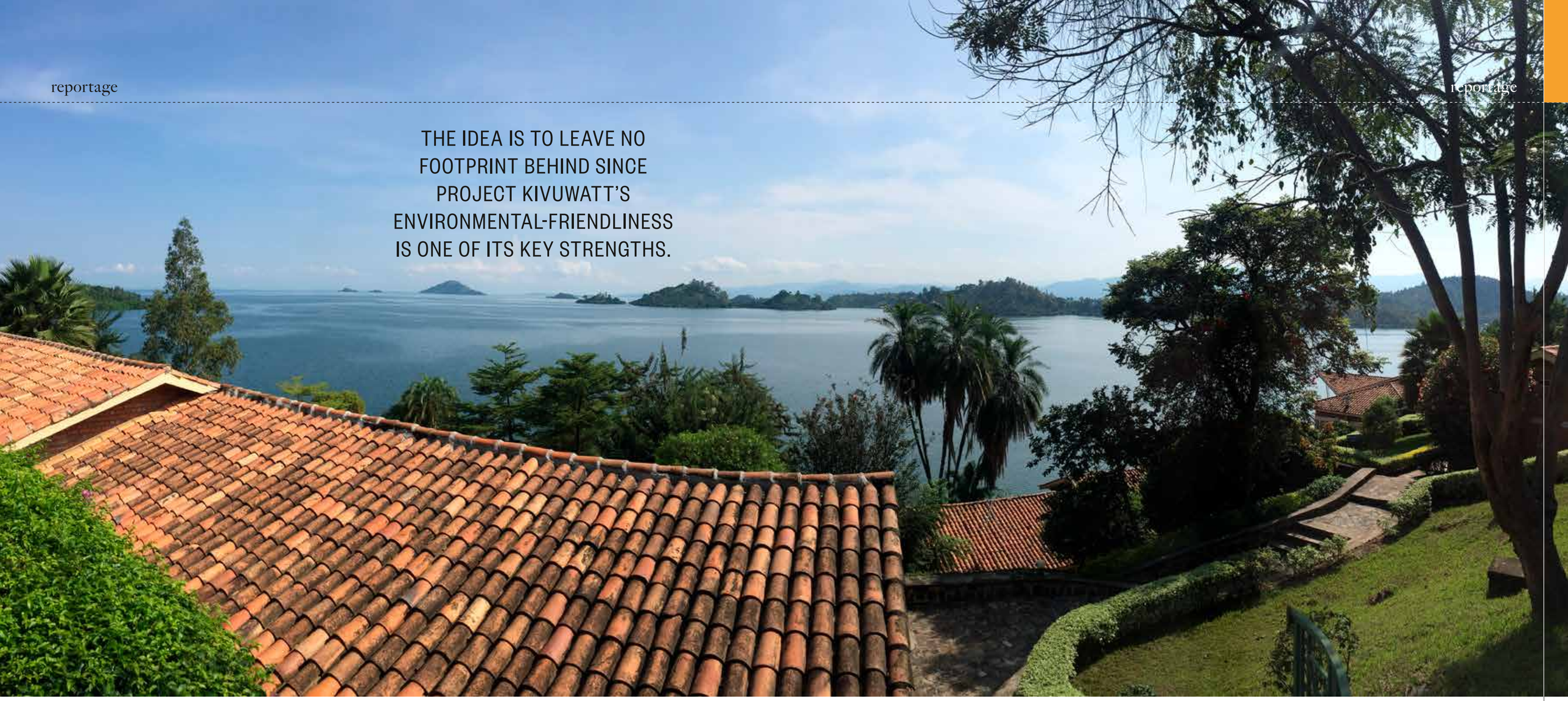
By generating power using available local resources, KivuWatt could bring better energy pricing and enable more connectivity to the electricity grid.

reportage

WÄRTSILÄ 34SG ENGINES ARE OPTIMISED TO RUN ON LAKE KIVU'S GAS MIXES, WHICH HAS HELPED SCALE DOWN THE SIZE OF THE EXTRACTING BARGE AND REDUCE THE COSTS OF PRODUCING ELECTRICITY.

Dusk view of the floating barge in Lake Kivu providing methane gas to KivuWatt Gas Power Plant, Rwanda

reportage



THE IDEA IS TO LEAVE NO FOOTPRINT BEHIND SINCE PROJECT KIVUWATT'S ENVIRONMENTAL-FRIENDLINESS IS ONE OF ITS KEY STRENGTHS.

power plant. That pipe has been designed for 85% methane. So if our methane concentration is 80%, we need to feed them with 10% more gas to make sure the power plant reaches full production capacity," he says.

Wärtsilä 34SG engines are optimised to run on Lake Kivu's gas mixes that have a lower heating value than normal natural gas. This has helped scale down the size of the extracting barge and reduce the costs of producing electricity.

"The automatic adjustment of their engines is unique," continues Gummerus. "You just set up the power you want to get from the engines, and the engines adjust themselves depending on gas quality," he says in awe.

BLUEPRINT HASSLES

But designing a system to exploit the energy potential of methane while stabilising the lake and protecting the environment was no child's play. It took many years of hard work and planning, particularly since there was no point of reference from the past.

"In the oil and gas industry, there was already an application in use that could separate gas and oil from each other, but there was none to separate water and gas," Gummerus points out.

"We had to rely purely on computer simulations," he recalls. "Given the viscosities of water and gases, there was a lot of guesswork because the water was not clean water. In the design stage we didn't have very accurate information about the kind of water at 350 metres. We knew about gas concentrations, but there was no experience about how these factors affect computer simulations," he adds.

Corrosion was another factor the team had to consider. Since the water was very acidic, they had to look at how materials used to reach the lake's depths would react. After several permutations, a system was put in place. But the teams working on the project have to stay alert at all times to make sure no slips affect the ecology in any way.

"We need to be very sure that we are not bringing any water or gas to the surface, because water from that depth is full of nutrition. If there's any water coming to the surface, it would pollute the lake because it would boost the plankton growth," warns Gummerus. He adds that they also have water safety systems in place to spot any gas leak in the process.

The idea is to leave no footprint behind since Project KivuWatt's environmental-friendliness is one of its key strengths.

THE WAY FORWARD

But both Gummerus and Strandback believe the end result is worth all the effort. After all, their cooperation has worked wonders for the project. "Wärtsilä introduced the project to Contour Global about 9 years ago, so in a way, we consider Wärtsilä as the godfather to our baby," says Gummerus, giving the credit where it's due.

"The fact that we can be part of the project to utilise hazardous gas and convert it into energy is great," acknowledges Strandback.

KivuWatt is now moving to the next phase to add additional gas extraction and power plant capacity in the coming years. The future looks promising both for the project and for the people of Rwanda, where widespread access to renewable energy is highly likely.

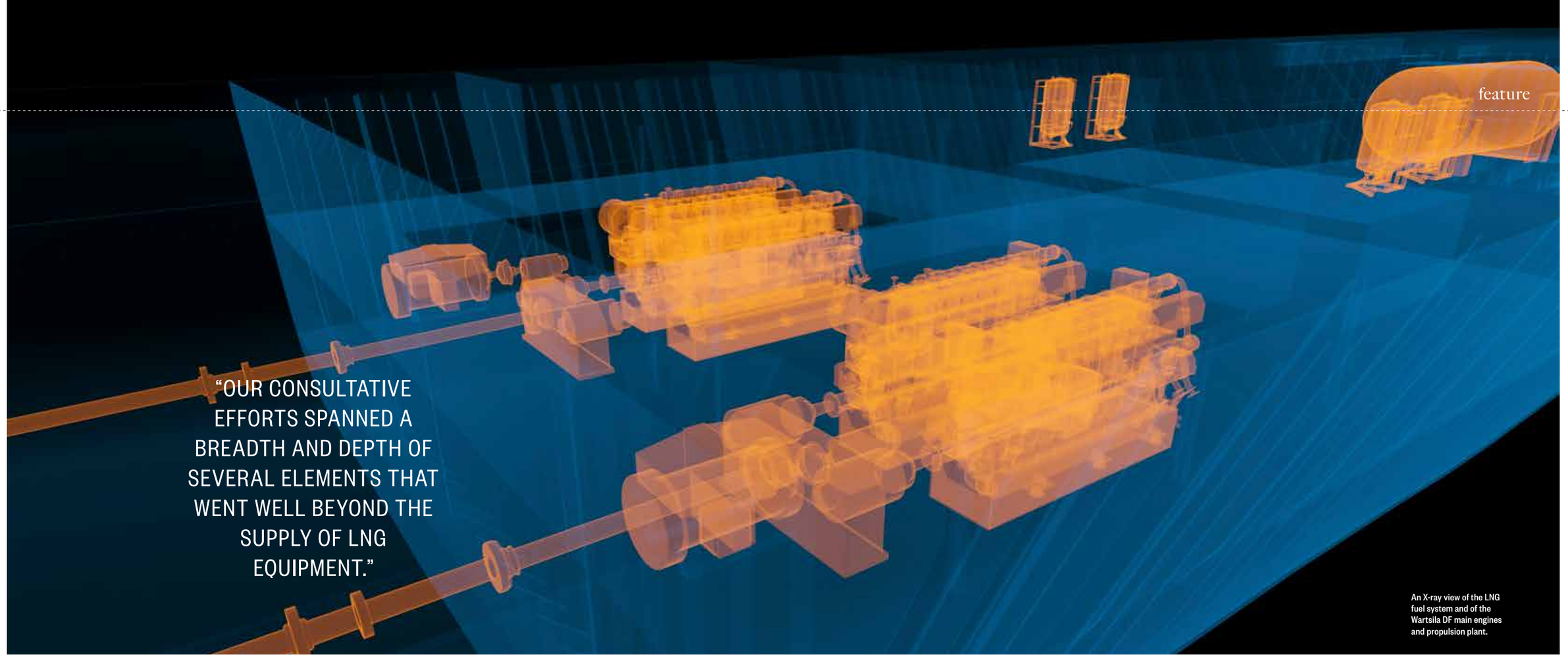
Meanwhile, Gummerus is glad he recorded a video of the engines revving and the first signs of smoke, or the lack of it, since the gas was very clean. It's a memory and milestone worth capturing.

TEXT: NIC TOWNSEND **PHOTO & ILLUSTRATION:** WÄRTSILÄ

PROPELLING BC FERRIES FORWARD

As BC Ferries makes the switch to LNG, Wärtsilä is supplying more than just the equipment – it has been a partner through every stage of the process, from initial design and installation to staff training and ongoing support.

feature



> “OUR CONSULTATIVE EFFORTS SPANNED A BREADTH AND DEPTH OF SEVERAL ELEMENTS THAT WENT WELL BEYOND THE SUPPLY OF LNG EQUIPMENT.”

An X-ray view of the LNG fuel system and of the Wartsila DF main engines and propulsion plant.

Every day, year-round, BC Ferries transports tens of thousands of cars and people across British Columbia, Canada, making it one of the biggest ferry companies in the world. Its fleet of 34 vessels serves 47 terminals across the region and acts as an essential link between many island communities and the Canadian mainland. In 2012, in an attempt to lessen its environmental impact and reduce fuel costs, BC Ferries began looking into alternative fuels for its future fleet.

“We are very conscious of our environmental impact and want to help preserve the pristine west coast of Canada,” says **Mark Wilson**, Vice President, Engineering, BC Ferries. “Even though we already meet the current regulations, we are always looking at ways to improve our environmental footprint even further.”

Since British Columbia boasts a huge abundance of natural gas – a reserve supply exceeding 1000 years – and the local government has introduced strong incentives to encourage the adoption of gas as a fuel source, LNG immediately stood out as the best option. Not only would it be cost-effective, but it would also reduce all emissions. Compared with diesel, its emitted CO_2 is 25% less, NO_x down by over 50% and SO_x by 85%.

Consequently, three new LNG-powered vessels were commissioned and are currently under construction at the Remontowa shipyard in Poland. The first vessel is expected to be delivered before the end of the year. Concurrently, BC Ferries’ two biggest vessels, the Spirit of British Columbia and Spirit of Vancouver Island, will undergo an upgrade and conversion to LNG propulsion. Wärtsilä is supplying the complete power, electrical and automation systems, as well as the LNG fuel storage and bunkering installation for the three new vessels.

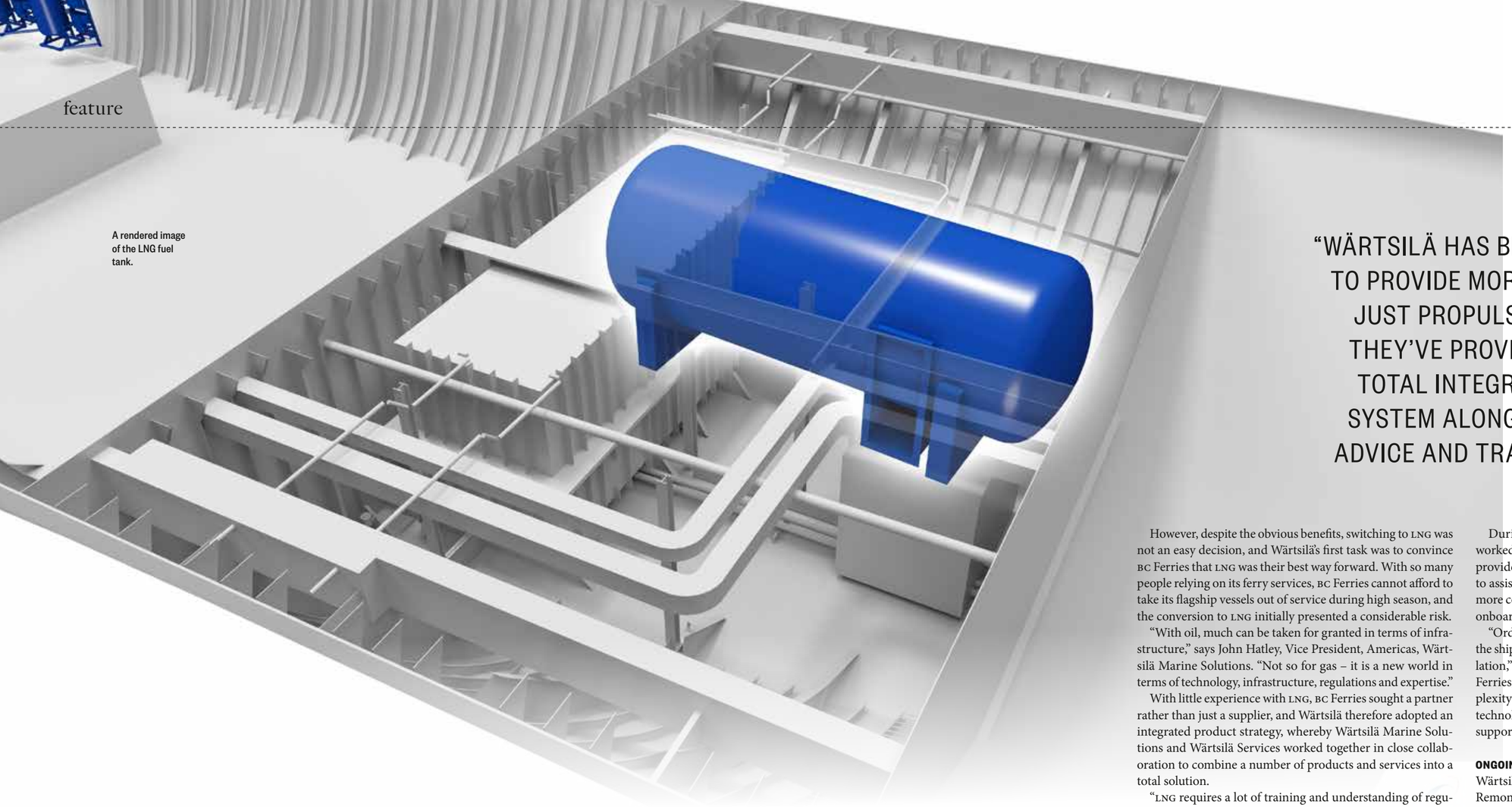
A NEW LNG WORLD

For the conversion of the ‘Spirit’ class vessels, Wärtsilä will supply the engines, the LNGPac (Wärtsilä’s complete fuel gas handling system for LNG) and gears. At the same time, Wärtsilä Propulsion Services will carry out mid-life upgrades of the controllable pitch propeller and tunnel thrusters and refurbish the engine rooms’ electrical and automation systems.

“BC Ferries’ fuel bill is huge, around USD 120 million annually, and we need to improve operating costs in order to keep fares low,” Wilson says. “Once completed, these five vessels are expected to save around 12 million litres of diesel a year. We also expect to reduce CO_2 emissions by 9000 tonnes annually, which is the equivalent of taking approximately 1900 vehicles off the road per year.”

This rendering illustrates the LNG fuel system on board a BC Ferries vessel of the Spirit class.

feature



A rendered image of the LNG fuel tank.

A rendering of the customised LNG conversion platform for BC Ferries.

"WÄRTSILÄ HAS BEEN ABLE TO PROVIDE MORE THAN JUST PROPULSION – THEY'VE PROVIDED A TOTAL INTEGRATED SYSTEM ALONG WITH ADVICE AND TRAINING."

However, despite the obvious benefits, switching to LNG was not an easy decision, and Wärtsilä's first task was to convince BC Ferries that LNG was their best way forward. With so many people relying on its ferry services, BC Ferries cannot afford to take its flagship vessels out of service during high season, and the conversion to LNG initially presented a considerable risk.

"With oil, much can be taken for granted in terms of infrastructure," says John Hatley, Vice President, Americas, Wärtsilä Marine Solutions. "Not so for gas – it is a new world in terms of technology, infrastructure, regulations and expertise."

With little experience with LNG, BC Ferries sought a partner rather than just a supplier, and Wärtsilä therefore adopted an integrated product strategy, whereby Wärtsilä Marine Solutions and Wärtsilä Services worked together in close collaboration to combine a number of products and services into a total solution.

"LNG requires a lot of training and understanding of regulations, as well as lots of new infrastructure in place," Wilson says. "Wärtsilä has a strong track record with LNG, and their technology is well-proven. But they've been able to provide more than just propulsion – they've provided a total integrated system along with advice and training."

AN ADAPTABLE PLATFORM

The partnership with BC Ferries began in the early design phase, with the two companies working closely together to develop a basic platform that could be adapted and used for all future ferries.

"Our system designs included the same core, bridge and engine room, and we proposed several variations so that BC Ferries can still adapt the basic platform for different routes and assignments," recalls **Quentin Stewart**, Sales Manager, Wärtsilä Marine Solutions, North America.

The three new vessels will be the first of a new generation of vessels for BC Ferries. Any additional vessels over the coming years will be based on the same standard concept, thus reducing the variety of models in its fleet.

During the construction of the new vessels, Wärtsilä has worked closely with the Remontowa shipyard in Poland and provided engineers and on-site support. They will continue to assist with the conversion projects, too, which will be even more complex due to the interaction with existing equipment onboard.

"Ordinarily, we would just supply individual machinery to the shipyard, which would then solely be responsible for installation," says **Wilco van der Linden**, GM Merchant, Cruise & Ferries, Wärtsilä Marine Solutions. "But because of the complexity of the installation and the fact that this is such new technology, we're providing additional assistance and on-site support."

ONGOING PARTNERSHIP

Wärtsilä's engineers will continue to work closely with the Remontowa shipyard throughout the trials and final commissioning of the vessels, but the partnership will not end once the vessels are delivered to BC Ferries. Instead, Wärtsilä Services will begin a series of special training programmes for BC Ferries' personnel.

"We've put together a package specially for BC Ferries, which will help train their engineers and crew on how to operate the new systems," says **Bob Miller**, Training Manager, Wärtsilä Services. "We are also working closely with marine training centres on regulatory courses concerning LNG, by providing information on our systems and access to our simulators. The training program is not a one-off but will be continuous and part of our long-term commitment to the vessels for their entire lifetime."

Overall, the project is demonstrating Wärtsilä's ability to tailor a total solution. "The key for us was to convince BC Ferries that we could take the risk out of LNG," adds **Mark Keneford**, General Manager Marine Solutions. "Over the past five years we've been working closely together to explain how LNG works, while also listening to them and offering engineering support. By sticking with them and supporting them through that process, we've been able to give them the confidence that LNG is economically and technically feasible for them."

TEXT: STEVE ROMAN **PHOTO & ILLUSTRATION:** WÄRTSILÄ

CLEAN AND CLEAR

Whether spurred by tightening regulations, customer demand or enlightened corporate policy, today's shipowners are constantly looking for ways to have their vessels run leaner and cleaner. Wärtsilä's Environmental Solutions business line provides the tools they need to achieve their goals.

In hindsight, it seems inevitable that the world would finally get tough on marine-generated pollution in the early 21st century. The frenzied pace of global industrialisation in recent years sparked a chain reaction of increased maritime traffic, noticeably higher environmental impact and, finally, pressure on politicians to act.

"It's common opinion nowadays that something needs to be done," said **Juha Kytölä**, Vice President for Environmental Solutions at Wärtsilä Marine Solutions. "Shipping itself is of course mainly happening on the open sea, so people don't see it in their daily lives except in the major harbours. That said, many of the impacts on the environment are spreading further around them along the shipping routes."

The largest areas of concern for environmental advocates and regulators are the exhaust gasses and particulates generated by engines as well as the liquid emissions such as ballast and wastewater.

While some shipowners are making improvements to their systems out of altruism or to take advantage of national incentive schemes set up by the likes of Sweden and Norway, the biggest driver for change has been an array of increasingly strict regulations set by the International Maritime Organization (IMO), the UN body that governs global shipping. Since 2000, numerous new IMO rules have come into force to clamp down on various types of pollution. More of these, including some true game-changers, are right around the corner.

CLEARING THE AIR

When it comes to ship engine emissions, most of the regulatory focus is currently on sulphur oxides (SO_x) and nitrogen oxides (NO_x). Wärtsilä offers some tried-and-true technologies to tackle both. Ships can continue to run on traditional fuels, rather than switching to low-sulphur fuels, with the help of exhaust scrubbers (see related sidebar), which serve the dual function of reducing SO_x and particulates. For NO_x reduction, a Selective Catalytic Reactor behind the scrubber uses urea to convert NO_x to nitrogen and oxygen.

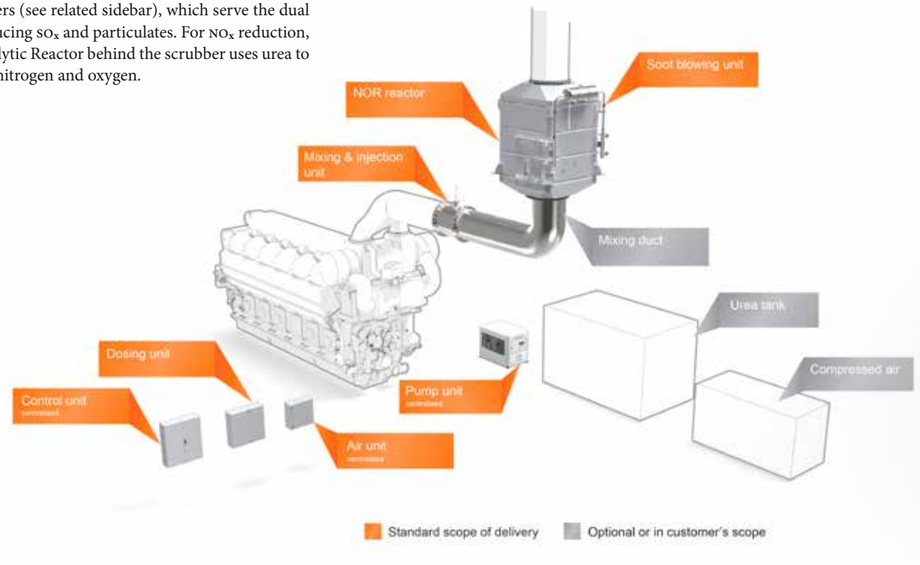
The next area to watch, according to Kytölä, is CO_2, a topic that has come even more into the fore since the Paris agreement on greenhouse gas emissions was reached in December 2015.

"In the long run, CO_2 emissions of ships will be regulated, but the concept is not yet formulated," Kytölä says. CO_2 reduction is a complex problem that involves the efficiency of all the ship's systems, from propulsion to on-board equipment and lighting. Newly built ships are already required to follow an EEDI, or Energy Efficiency Design Index, in their design. "But this is only a first, small step," Kytölä explains. CO_2 regulation, he says, "will have a big impact on the operation and design of ships for the near term, but we don't yet know how big. We at Wärtsilä believe that this is an area where we need to be strongly active and contribute to the improvements in the industry."

Forward-thinking shipowners who want to reduce their SO_x, NO_x and CO_2 all in one go can take advantage of another approach offered by Wärtsilä, namely converting their engines to run on natural gas or biofuels – a move that can come with the added bonus of an operational cost savings in many cases according to Kytölä. Additionally, hybrid and battery solutions are available already now.

INVADERS AND OTHER THREATS

Along with global warming and disappearing species, a top concern among UN environment watchers is species invasion, the phenomenon by which organisms are picked up from one area of the world and dropped off in another, often with devastating effects on local ecosystems. Unfortunately, the ballast



Schematic of the Selective Catalytic Reactor.

Wet scrubbers are added to ships to reduce sulphur output.

ALL EYES ON 2020

In late October, the gaze of the world's maritime industry was firmly fixed on London where the IMO's Marine Environment Protection Committee was set to deliver its much-anticipated ruling on sulphur emissions. Their verdict: a planned global cap of 0.5% sulphur content in ships' fuel will come into effect in 2020, as originally envisioned, rather than pushed back to 2025.

Considering that the cap currently stands at 3.5 percent, this scale of reduction is unprecedented. For many shipowners, though, the writing was already on the wall even before the MEPC met. The EU announced that it would be implementing its own 0.5% sulphur cap, applicable within 200 nautical miles of its coastlines from 2020, regardless of what the IMO would decide.

In other words, a sizeable portion of shipowners have already been taking a hard look at compliance strategies, no doubt taking cues from those working in the world's Sulphur Emission Control Areas, or SECAs, where controls are even tighter. Now the rest are in the same boat, as it were, looking for ways to reach the 0.5% target within the coming three years.

"The easiest and most straightforward is to run on a low-sulphur fuel," says **Sigurd Jenssen**, Director of Exhaust Gas Cleaning at Wärtsilä Environmental Solutions. Choices include desulphurised heavy fuel oil, distilled fuels such as marine gas oil, and the fairly nascent LNG.

However, for most ships, the more attractive route is to stick with traditional fuel and add wet scrubbers to reach an equivalent reduction in sulphur output. These systems spray water into the exhaust, capturing the SO_x and particulate matter before the water is cleaned and discharged overboard.

"It's a well-known technology," says Jenssen. "We still haven't found a ship where it's impossible to retrofit a scrubber. You can always find space."

While Jenssen notes that a majority of shipowners have been taking a wait-and-see approach to the IMO's regulations, some large operators have already been installing scrubbers in anticipation of the upcoming changes. "They get a cost savings when working inside the SECAs, but they're also getting know-how in operating these systems – first-hand experience before the global cap is rolled out."

"WE STILL HAVEN'T FOUND A SHIP WHERE IT'S IMPOSSIBLE TO RETROFIT A SCRUBBER. YOU CAN ALWAYS FIND SPACE."

feature

water that ships carry from port to port acts as a perfect vector for such invasion, posing a risk to coastal areas.

There is relief in sight: In September 2017, the IMO's landmark convention on ballast water will come into effect, requiring all ships that haven't already done so to install an approved ballast water management system (BWMS) when they next undergo their mandatory five-year drydock cycle.

"There will now be 34,000 ships around the world that will have to install a BWMS, so demand will be enormous," Kytölä says. He predicts that Wärtsilä's own type-approved Aquarius BWMS systems, which either use a combination of electro-chlorination and filtration or UV light and filtration, will attract a healthy share of the market.

Though the BWM convention certainly marks a sea change in the marine industry, Kytölä points out that regulations have been incrementally tightening for other types of liquid emissions as well, namely wastewater and bilge water. Wärtsilä provides advanced systems to handle both, as well as solutions that can make ships greener in other ways. Examples include seawater desalination systems that use the engine's waste heat, thus improving efficiency, and inert gas systems for tankers that help prevent accidents and environmental catastrophe.

Kytölä says that many long-time customers, especially those he terms 'advanced thinkers', are in constant dialogue with Wärtsilä about how they can take the latest environmental solutions on board. Lately, particularly as regulatory conditions change, there have been a fair number of inquiries from new customers as well. "That's probably because we're known in the market as a very technologically and environmentally oriented player."

What's encouraging, according to Kytölä, is that the industry is well versed in the upcoming changes and seems ready to face them head-on. "As an overall picture, I would say that all the shipyards are very well prepared. They are aware of what's coming and they have an opinion on how to do things."

An exhaust cleaning system is lifted onboard the MV Tarago.

The Ro-Ro vessel "Theben" is equipped with an exhaust gas cleaning (EGC) System from Wärtsilä. The system is the first EGC to be approved by an Asian flag authority.

"CO_2 REGULATION IS AN AREA WHERE WE NEED TO BE STRONGLY ACTIVE AND CONTRIBUTE TO THE IMPROVEMENTS IN THE INDUSTRY."

TEXT: IAN FENTON **PHOTO:** WÄRTSILÄ


Jaakko Eskola takes center stage.


CEO Jaakko Eskola discussing with analysts

Natalia Valtasaari welcomes the biggest crowd in the history of Wärtsilä's Capital Markets Days.


Roger Holm talks about the opportunities in Marine Solutions.

A RESOUNDING SUCCESS

Digitalisation takes centre stage on Capital Markets Day 2016.

Wärtsilä's Capital Markets Day 2016 took place on Thursday, 29 September, at Helsinki's Finlandia Hall. With attendees from some of Europe's leading financial institutions, eager to hear about Wärtsilä's latest developments and future outlook, this marks one of the most important dates in the IR calendar.

The turnout was at its highest ever, with nearly 100 representatives of banks and other investment houses present and more than 50 logging on to the live webcast. As well as showcasing varied perspectives from around the organisation, the Board of Management also made themselves available for questions and conversation over lunch in between presentations.

CEO **Jaakko Eskola** opened the proceedings with the broad strokes, signposting both the opportunities in each market and Wärtsilä's unique strengths as a business, which help us to capitalise on that potential. Then the floor was given to CFO **Marco Wirén**, who reassured attendees of the company's excellent financial stability and prospects, and clarified enquiries from the floor relating to the order book distribution and our flexibility in adjusting capacity to market demand.

IN THE SPOTLIGHT

Before too long, attention was transferred towards detailed analysis of Wärtsilä's business. Following thorough accounts of the current activities and most exciting developments within the business areas, presented by each area head in turn, the audience was particularly interested in challenging the models and concepts they had been presented with.

Perhaps more than any other stakeholder group, capital-market investors are inclined to get to the heart of a question, seeking firm answers backed up by hard data and market experience. In answering their questions, the business area leaders brought facts from the market and evidence from documented customer cases to the table to convince those present of our strategic confidence.

Each business area head approached the crowd differently, letting their personalities show, either through good-natured humour or persuasive explanation of the core messages for their sector. For **Javier Cavada** of Energy Solutions this meant a rousing, friendly approach to the audience that won smiles and, just as intended, succeeded in exciting those present. The answers provided by **Pierpaolo Barbone** of Services highlighted his confidence in the findings and strategic manoeuvres he presented. For **Roger Holm** of Marine Solutions, in the position of addressing a market currently in a slow phase of its cycle, the task became pointing out the specific areas in which Wärtsilä still finds opportunities, an approach whose wisdom investors seemed to readily accept.

THE FUTURE IS DIGITAL

One of the event's main themes was digitalisation, with specific examples highlighted throughout the day by the heads of each business area. These were followed by the introduction of **Marco Ryan** as Chief Digital Officer, who closed the day's discussions with his early analysis of Wärtsilä's increasing emphasis on digital development.

His findings continued the forward-looking tone of the other speakers, presenting the conclusion that Wärtsilä is in a strong position for digital transformation, with healthy data, strong digital solutions already in place, and enthusiastic commitment towards this direction at all levels of the organisation. Here, as elsewhere, the journey continues in fine spirit.

THE TURNOUT WAS AT ITS HIGHEST EVER, WITH NEARLY 100 REPRESENTATIVES OF BANKS AND OTHER INVESTMENT HOUSES PRESENT AND MORE THAN 50 LOGGING ON TO THE LIVE WEBCAST.

TEXT: RICHARD ORANGE **PHOTO:** iSTOCK & WÄRTSILÄ **ILLUSTRATION:** WÄRTSILÄ

WHAT LIES **BENEATH?**

Researcher and conservationist Jacques Cousteau is quoted as saying, “For most of history, man has had to fight nature to survive; in this century he is beginning to realise that, in order to survive, he must protect it.” Greater enforcement of marine legislation and the latest technologies to treat ballast water and wastewater are beginning to help vessels do just that.

“THERE ARE A LOT OF PEOPLE WHO HAVE ENTERED THE BALLAST MARKET BECAUSE THE OPPORTUNITY APPEARS SO BIG.”

Wärtsilä BWMS being tested at sea.

Ships today may get away with water pollution on a scale that would never be allowed on land. Some dump large quantities of human effluent into the sea after treatment that often comes down to little more than dilution. Container vessels suck up plant and animal life every time they take up ballast water, and then they release it on the other side of the world, introducing alien species that can devastate local ecologies. Thankfully, this is starting to change. With new regulations in both areas, it will be imperative that ship owners install type-approved water treatment systems to remain compliant.

BWM IN ACTION

On 8 September 2017, the Ballast Water Management (BWM) convention will finally come into force, 12 years after it was agreed. From that day, every ship above 400 gross register tonnes (GRT) will have to install a type-approved ballast treatment system at its next mandatory International Oil Pollution Prevention (IOPP) survey.

That means an estimated 34,000 new ballast water management systems will need to be installed over five years, a market estimated at EUR 12–13 billion.

“It’s quite competitive. There are a lot of people who have entered the ballast market because the opportunity appears so big,” says **Joe Thomas**, Wärtsilä’s director of Ballast Water Management Systems. “We want to be a leader, and be the supplier of choice for our customers.”

Thomas estimates that Wärtsilä’s Aquarius range of ballast water management systems already has some 50+ type-approved rivals. But unlike the competition, Wärtsilä offers both an ultraviolet (UV) treatment solution and an electrochlorination (EC) treatment solution.

“Our approach from the very beginning was to offer technology choice, to accommodate customers generally having a range of ships in their fleets,” Thomas says.

The Aquarius UV system is most economical for ships whose ballast pumps have a capacity of up to 1000 cubic metres per hour. It uses ultraviolet light to kill bacteria, viruses and other microorganisms.

For ships whose ballast pumps have a capacity above 1500 cubic metres per hour, the Aquarius EC system is more cost-effective. It generates sodium hypochlorite (a disinfectant) from the sea water during uptake and injects this back in to treat the ballast water that is pumped into ships’ ballast tanks. The disinfectant breaks down naturally over time, but to make sure discharges comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) limits, ballast water is neutralised with sodium bisulphite if necessary before discharge.

Both the UV and EC systems share the same automatic backwash filter system, which removes larger organic life and sediments before treatment, and they have similar control systems, making it easier for ship owners to manage spare parts, crew training and the like.

Perhaps Wärtsilä's greatest advantages lie in its established network of global service centres.

"There are not very many of our competitors who can give the level of global support that Wärtsilä can provide," Thomas points out. "I would say Wärtsilä is head and shoulders above many of our competitors in this respect."

Wärtsilä has aimed to make the system as simple and robust as possible. There is no mechanism for assessing the quality of incoming seawater and then varying treatment accordingly.

"It's 'on' or 'off', and in that sense, the system is more robust and reliable," Thomas argues. Instead Wärtsilä has fixed the dose of UV and disinfectant at a sufficiently high level that it will perform as required by regulation.

TREATING WASTEWATER

When shipping inspectors from one of the world's leading maritime states recently carried out a spot check of ship wastewater treatment systems, they confirmed the worst: the onboard sewage treatment plants on most vessels they checked were discharging virtually untreated raw sewage.

The photographs they took of plastic bottles filled with dark brown discharge powerfully illustrate the near complete failure of the International Maritime Organization's MARPOL Annex IV to protect seas and coastlines from ships' sewage pollution.

"It's really astonishing to see how superior the sewage discharge limits appear to be on paper, while at the same time, how bad the reality gets," says Dr **Wei Chen**, Future Programme Development Manager at Wärtsilä Water Systems.

According to Chen, this is because the MARPOL Annex IV has no performance verification or compliance monitoring. All that is required is for each vessel to have a type-approved plant on board.

It is only in Alaska, where environmental authorities come on board vessels and take samples of the wastewater about to be discharged, that cruise ships have installed Advanced Wastewater Treatment (AWT) solutions, with the majority of vessels discharging in Alaskan waters using Wärtsilä's Membrane Bio-Reactor System, which can treat both black and grey water.

The system consists of two pre-filtration units, a bioreactor and ultrafiltration membrane modules to produce clean water and concentrated sludge, which is dried and either incinerated or offloaded in port.

Although the multi-stage treatment is complicated, Wärtsilä has designed the system to be easy to operate and maintain.

Some cruise ships operating in the Baltic Sea already use AWT voluntarily, but section 4.2 of the Marine Environment Protection Committee (MEPC) resolution 227(64), which comes into force in June 2019 for new vessels and in 2021 for existing ones, is likely to increase demand so long as it is properly enforced.

"AWTS have been a true revolution for the cruise sector," Chen says. "However, in the context of Baltic Sea, it is often forgotten that AWT only existed because Alaskan regulators do enforce their rules. The moment enforcement is taken away, corners are cut."

There are already signs this might happen. At least one of the sewage treatment plants (STP) approved to meet the new Baltic nutrients requirements purports to remove phosphorus without producing solid residues.

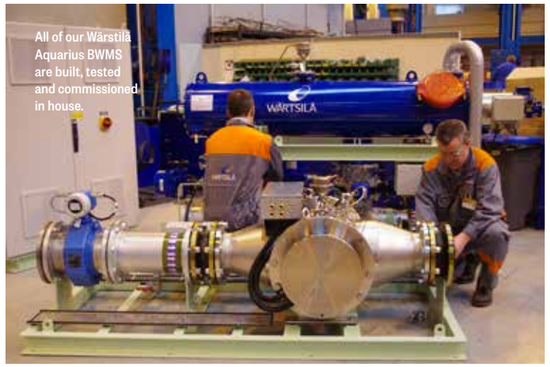
"This cannot possibly be true. But this STP is type-approved and ready to serve to 'protect' the Baltic Sea," Wei says.

There is a similar problem with the latest MEPC guidelines limiting the use of dilution in sewage treatment, which entered into force in January 2016. Most existing STPS have no flow metres installed to make checking compliance possible. Some even add untreated grey water to the last stage of the process.

"It so far has failed," Chen argues. "For STPS certified to dilute, Qi and Qe [the volume of sewage flowing into the system and treated water out] are not actually made visible to operators or inspectors, making it impossible to verify conformity on board."

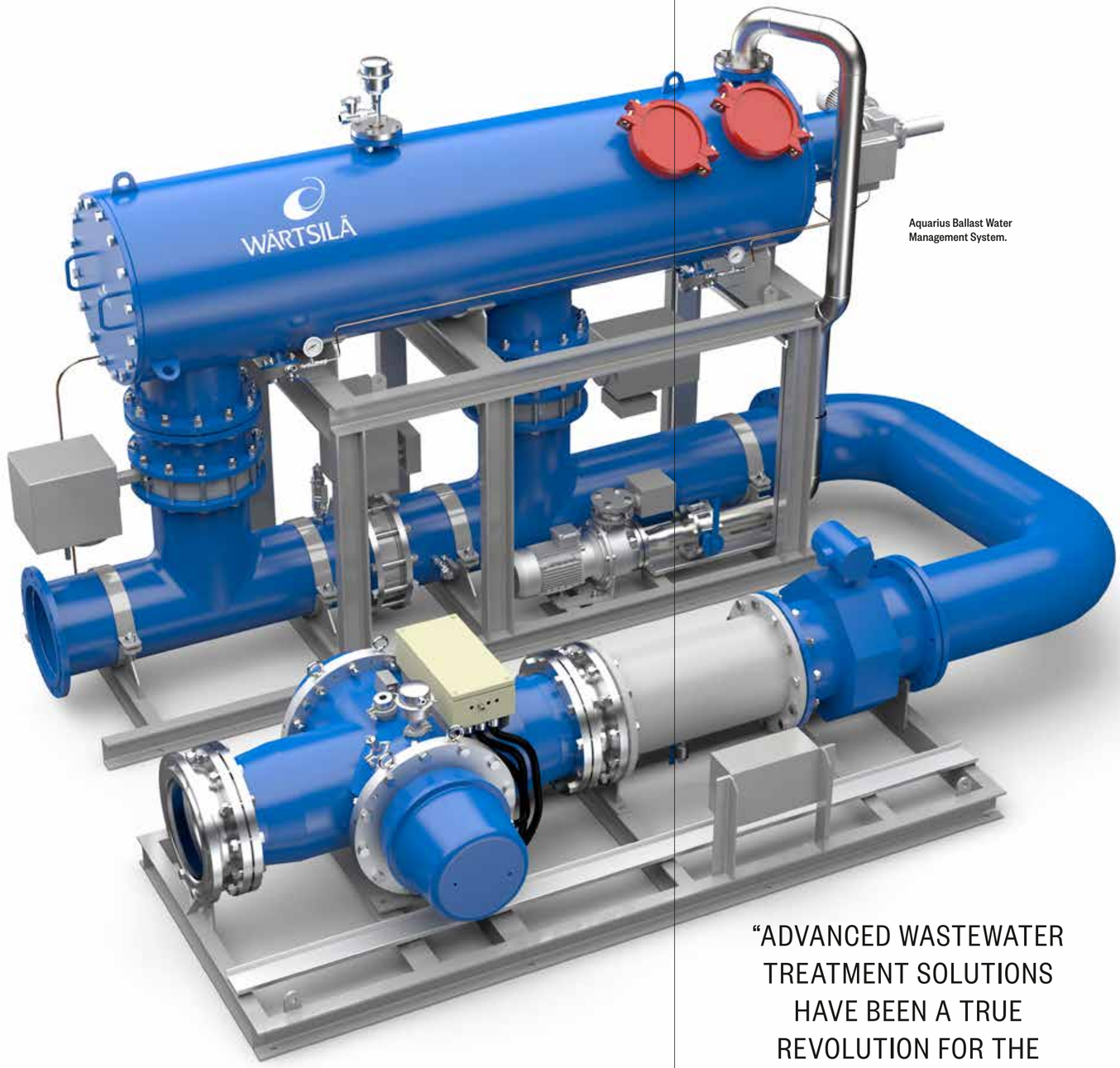
Wärtsilä's Super Trident STP, which has been refined over four decades, does not use dilution. It instead uses the activated sludge system, which accelerates natural processes, together with chemical disinfection. Unlike most other type-approved STPS, it has a dechlorination stage.

The plants are controlled automatically, saving on crew time and reducing maintenance requirements.



All of our Wärstilä Aquarius BWMS are built, tested and commissioned in house.


Wärtsilä sewage treatment plants are compact and modular in design.



Aquarius Ballast Water Management System.

"ADVANCED WASTEWATER TREATMENT SOLUTIONS HAVE BEEN A TRUE REVOLUTION FOR THE CRUISE SECTOR."

TEXT: PAUL CONNOLLY **PHOTO:** MATT KEEBLE

THE PERFECT DIGITAL FIT

Wärtsilä's recent purchase of Finnish marine technology start-up Eniram underlines the unstoppable nature of digitalisation within the marine industry.

SkyLight uses real-time data for fuel performance optimisation.

Until the last couple of years, the marine industry has been left largely unaffected by digital transformation, a term that refers to the changes associated with the application of digital technology to all areas of business.

The real-time analysis of "big data" (the huge amount of raw information generated by all sorts of machines and systems that, with the right software, can be analysed to reveal trends, spot problems and so on) is a technological innovation as it can provide new ways of thinking about issues and identifying opportunities.

The marine industry is generating massive amounts of data from vessel operations and other sources, but much of it has not – until now – been used systematically.

Pierpaolo Barbone, President of Wärtsilä Services, is passionate about the potential of digitalisation in the marine industry and is certain the acquisition of Eniram will help Wärtsilä stay at the forefront of new business opportunities.

"Eniram has world-class analytics capabilities, and by joining forces, we can provide our customers with an unbeatable offering on both the vessel and fleet level," he says.

"ENIRAM'S OFFERING AND SOLUTIONS complement the recently launched Wärtsilä Genius Services portfolio. Together, we will enable our customers to optimise their assets and improve predictability, as well as support them with real-time analytics."

Barbone says the acquisition will enable Wärtsilä to grow and strengthen its digital offering and in-house capabilities, specifically in data analytics, modelling and performance optimisation.

Eniram's solutions range from single onboard applications for trim, speed and consumption optimisation to comprehensive vessel and fleet analysis.

The company's solutions are installed in over 270 vessels, saving fuel and increasing efficiency.

"The acquisition of Eniram is important," says Barbone, "because it is part of Wärtsilä's evolution and ambition to move from hardware to software. Years ago, we were just selling spare parts and technical expertise, but we've moved on from that. We now offer long-term agreements to help optimise the maintenance cycle of our customers' installations and even operate their plants. Digitalisation is adding a new dimension: the optimisation of a customer's business. We started this journey supporting our customers with condition-based maintenance and helping to optimise their equipment through our Wärtsilä Genius Services."

But with the addition of Eniram's value proposition to Wärtsilä's product range, Barbone wants to offer much more.

"OUR BUSINESS TARGET IS to use digitalisation to transform our offerings from hardware to software and to optimise our customers' business. What does it mean to optimise customer business? Let me explain.

"If the customer's vessel consumed less fuel along a certain route and under given weather conditions, this saves him money. If the trim is adjusted to make the ship sailing that little bit smoother, this saves him money. If we optimise the maintenance of the equipment extending the maintenance interval, this saves him money.

"This is the reason we have decided to make this journey towards digitalisation."

Eniram's acquisition complements the digitalisation customer-care circle for Wärtsilä, and "the recently launched SkyLight product, specifically dedicated to merchant vessels, opens new horizons," says Barbone.

"The combination of Wärtsilä's competencies on the equipment side and Eniram's analytics and vessel and fleets optimisation is unbeatable. It really is the perfect fit."

A FORCE TO RECKON WITH

Eniram and Wärtsilä are launching SkyLight, a fleet performance monitoring service that enables merchant shipping operators to operate more efficiently and cost-effectively.

Every five minutes, SkyLight collects data about the ship's movements and is sent via satellite to Eniram's data centre. This data, together with the vessel's noon reports (a format that some 80% of vessels still use), is combined and enhanced with meteorological data, sea state and currents to model the vessel's speed and fuel performance. This makes it possible to calculate very accurate fuel-speed curves without onboard integration or costly installations.

Ship operators can use SkyLight to compare the performance of each vessel in their fleet. The software keeps records of ships' performances, enabling quicker reporting, planning and cost optimisation.

"Access to fuel and speed performance data increases visibility and supports the optimisation of the vessel's performance. This way, ship operators can manage their business more effectively," says **Jan Wilhelmsson**, Vice President, Commercial Shipping at Eniram. "Delivering performance monitoring through portable equipment as a service enables operators with shorter business cycles to get the benefits of advanced data analytics. As satellite connectivity is rapidly improving, this type of service is a natural first step in the utilisation of real-time data for fuel performance optimisation."

According to Barbone, SkyLight gives Wärtsilä access to almost 40,000 merchant marine installations on which SkyLight could be utilised.

"THE ACQUISITION OF ENIRAM IS IMPORTANT BECAUSE IT IS PART OF WÄRTSILÄ'S EVOLUTION AND AMBITION TO MOVE FROM HARDWARE TO SOFTWARE."

TEXT: ANN TÖRNKVIST **PHOTO:** POLFOTO / JAN GRARUP

The sea respected our manhood

Carsten Jensen is 63, the English cannonball on his coffee table is 209, and his best-selling seafarer novel is nine. The hit author tells Twentyfour7. about where he sailed to next.

passion

The writer **Carsten Jensen** is learning about CrossFit. Not through practice, but through listening, something he does really rather well. Barbells, weight plates, kettlebells – the young instructor goes through them all. They're far from Denmark, far from the town of Marstal that was the main character of his bestselling book, *We, the Drowned*.

They're at the family's French retreat, where only the pool offers a turquoise reminder of the sea. The CrossFit interview serves a purpose that has taken Jensen even farther away from the sea, to somewhere even drier. When we met Jensen, he was finishing another war novel but one set in landlocked Afghanistan.

There, in an abandoned Soviet factory, the Danish contingent of the NATO-led mission did CrossFit. So Jensen interviews his daughter's friend about her job as a CrossFit instructor. Because writing is all about research.

Helmand and Marstal. The settings sound so different, but the themes of these two books interlink. Identity and war; what we will fight for and why. *We, the Drowned* is the story of a town and its inhabitants. The "we" is a purposeful plural, because, while the book shifts from generation to generation and spans three wars, the "we" signals that this is the tale, not of one person, not even of a family, but of a town defined by its ships, by its sailors, and by the women and children left behind.

While Jensen is finishing his Afghanistan book, *We, the Drowned* very much sails on without him. A publishing house in Damascus recently bought the rights. That's just one of the translations out there: *Vi, de druknede* became *We, the Drowned*, *Nous, les noyés*, *Me hukkuneet*, *Wij, de verdronkenen*, *My, topielcy*.

That's the destiny of a good book. If discovered, it travels over time and place. Jensen himself went back, in preparation, to read many of the classics of the sea: **Melville**, **Jack London**, **Robert Louis Stevenson**. And for the upcoming book about Afghanistan, he revisited French explorer **André Malraux**' 1937 book *Man's Hope*, of which Jensen acquired a 1964 reprint.

As he reached the last pages, Jensen discovered an uncut fold, two pages that still clung to each other – an embrace to protect secrets. As he ripped them apart, he realised that this poor book had never been properly read. "I think in a

"I THINK IN A CHILDISH WAY, I FEEL THAT IF I WAS THAT BOOK, HOW SAD I WOULD BE NOT TO BE READ."

childish way, I feel that if I was that book, how sad I would be not to be read. My only purpose was to be read, and no one had bothered, and I would feel redeemed that finally someone was reading me."

THE STORYTELLER OF MARSTAL

We, the Drowned doesn't need that kind of redemption because it sold well, and in Marstal, where it is set, many consider it their book. In part, Jensen's method of research may have nurtured this sense of collective ownership. He held town meetings a handful of times to collect verbal histories and to borrow written accounts and diaries with which to inspire and fill the book. And there were not just words to discover but objects, too. The local museum had a special collection called simply "The room for things we brought home ourselves."

Even though Jensen left Marstal at age eight, he now fully belongs to it, as the town's storyteller – a role that has its perks. Such as the time when Jensen, a fitful and frantic, late-in-life learner driver, manged to crash into a car and a van in one ill-manoeuvred moment. But he was met not by fury from the car owner but with a copy of his book that she wanted him to sign. When the van driver showed up, he, too, brandished a book and a pen and a similar intent.

Soon after the book was published, a pair of old Marstal brothers showed up at a book signing. They lugged a bag, which from the brothers' tug and heave was clearly of considerable weight. *Clonk* it went, as the brothers placed it in front of him. Inside was a cannonball, and not just any cannonball: an English cannonball that ripped through a roof in Marstal during the Napoleonic wars and the same one that had been immortalised in *We, the Drowned*'s opening chapters. The family had kept it for soon-to-be two centuries.

A few years later, one of the brothers again met with Jensen and said that, as he grew older, he had no desire to leave the cannonball to the younger generation. "They don't care about history. If I give it to them, it will get lost, because they don't give a ****." The men drank beer together as the cannonball swapped hands, and today, Lord Nelson's memento has found a new home in Jensen's living room in Copenhagen, a much appreciated historical souvenir in the home that he shares with his wife and fellow author, **Liz Jensen**.

Jensen also met ancestors of the town's sadistic schoolteacher whose unrepentant, merciless violence is immortalised in the book. The boys' evasive tactics in the book – such as stuffing ink bottles in the heater so the classroom would fill with smoke and the teacher would have to dismiss them – are all real. It's the boys' own war while their fathers are at sea, and they think it will end when they finish school, but it doesn't. It just takes on new shapes.

A SAILOR'S LIFE

From **Nelson** to **Bismarck** and beyond, there is more than enough conflict in this 700-page novel – it's ever-present in *We, the Drowned*. Within a few pages, the reader is invited aboard a war ship, as Denmark fights the Germans in 1849 (the war lasted from 1848 to 1851). The scenes are chaotic, nightmarish and surreal, and the events described shatter sanity and any justice on board. A phrase embedded in the prose sticks out: "The sea respected our manhood, the cannonballs did not."

"A skilled sailor could ride through a storm. There were ways to handle a storm, while an unskilled sailor would go under," Jensen explains about the acquired skills and the mind-set necessary to brave the ocean. "In Danish, a sailor is 'sømand', literally sea man. There's an intimate connection between being a man and being a sailor; it's a kind of test of manhood."

But war, he says, showed no such respect.

"They realise that, when a cannonball comes sweeping across the deck, it doesn't distinguish. You can be a boy, you can be an experienced man, you can be strong, you can be weak – the cannonball does not distinguish," Jensen continues. "They are helpless. The war is beyond their experience. They cannot make it meaningful in any way."

We, the Drowned is not just, however, a story of warfare; it tells stories about the kind of private war the individual will undertake. An abandoned boy's search for his long-lost father. Or a wealthy widow trying to destroy Marstal's fleet so that the men will finally stay at home with their wives. The book offers no clear-cut happy endings, and one hopes to be forgiven for wondering if Jensen ever toyed with giving his characters some kind of joyful reprieve.

"It would be banal, and I'm not sentimental," Jensen says. "A sailor's life was fearful. Saying goodbye to a husband, brother or son was like a rehearsal of death because statistics showed some of them wouldn't come back."

"THERE'S AN INTIMATE CONNECTION BETWEEN BEING A MAN AND BEING A SAILOR; IT'S A KIND OF TEST OF MANHOOD."

TEXT: VICTORIA VEACH & LOTTA HEIKKERI

SOLAR MILESTONES

IN 2015, SOLAR ENERGY RECEIVED USD 2.4 BILLION FROM VENTURE CAPITAL AND PRIVATE EQUITY FIRMS, COMPARED WITH USD 0.5 BILLION AND USD 0.4 BILLION FOR BIOFUELS AND WIND, RESPECTIVELY. SOLAR ENERGY WAS ALSO HIGHLY FAVOURED BY PUBLIC MARKET INVESTMENTS, TAKING USD 10.1 BILLION COMPARED WITH USD 2 BILLION FOR WIND ENERGY.[1]

UTILITY-SCALE SOLAR ENERGY PROJECTS RECEIVED THE SECOND-HIGHEST AMOUNT OF INVESTMENT (BEHIND WIND-GENERATED POWER) IN 2015. HOWEVER, THE INVESTMENTS IN SOLAR ENERGY HAD THE LARGEST GROWTH COMPARED WITH BOTH 2014 INVESTMENTS AND THOSE MADE OVER THE PREVIOUS 10 YEARS.[1]

IN 2016, JOBS IN SOLAR ENERGY WILL OUTNUMBER JOBS IN OIL BY A PROJECTED 77% IN THE US.[2]

To the rooftops

Solar power is being brought to cities as well. Beginning in 2017, all new buildings built in San Francisco, California, with 10 or fewer floors must have rooftop solar panels installed.[3,4]

India recently opened the world's largest rooftop solar power plant in the state of Punjab. The power plant is expected to produce 11.5 MW of electricity and power 8000 homes.[5,6]

China is installing 100 MW of rooftop solar PV panels in 800 schools in Beijing[7]. In Bangladesh, a World Bank funded project has installed rooftop solar panels on more than 3.5 million rural homes, providing electricity for areas not accessible to the power grid.[8]

Air power

In 2015, the Solar Impulse airplane was the first completely solar-powered airplane to cross an ocean. Flying from Nagoya, Japan to Kalaeloa, Hawaii, the Solar Impulse used only energy generated and stored from solar panels mounted along the wings and top of the plane. The plane is equipped with more than 17,000 panels, has the wingspan of a Boeing 747, and has flown at a maximum of more than 8500 meters with a groundspeed of 216 km/hour[14,15]

Snow possibilities

In 2013, NASA deployed a solar-powered remotely operated vehicle for exploration and research (ROVER) on the Greenland ice sheet. The robot, named GROVER, has solar panels mounted in an inverted V to capture energy from the sun as well as from sunlight reflected off the snow. The robot is equipped with ground-penetrating radar to help researchers better understand changes to the ice sheet.[9,10]

Electricity afloat

In March 2016, the largest floating solar panel plant in the world began operating. The plant is located west of London on the Queen Elizabeth II reservoir. The energy produced from the plant's 23,000 solar panels will power the local water treatment plant operated by Thames Water and will provide clean water for London and south-east England.[11]

An even a bigger floating plant is being built in the Yamakura Dam in Japan. Planned to begin providing power in 2018, the floating plant will comprise nearly 51,000 panels, and it is estimated that it will produce enough electricity for nearly 5000 homes.[12,13]

Big plants

The race for the biggest solar plants is heating up. Dubai shattered all records for the cost of solar (3 US cents per kilowatt-hour) with the Earth's largest solar power plant. Solar (when delivered in 2018-2020) would become by far the lowest-cost option for generating electricity in the Gulf region, beating even coal-fired power plants.[18]

Earlier this year, Morocco opened the first phase of a large solar power plant. When all five phases are complete, this plant will be the largest (580 MW) solar power plant in the world. The plant is located along the edge of the Sahara Desert. The initial phase will produce power for 650,000 people. When the plant is complete in 2018, it will provide power to approximately 1.1 million people.[19]

Sunny commute

Metro of Santiago, serving 2.2 million passengers per day, is set to become the world's first public transport system to be fuelled by solar energy. The power will be generated from a 100-MW solar panel power plant. Construction will begin later this year. It is expected to be completed and powering Metro of Santiago by the end of 2017.[16]

A train depot for Singapore Metro Regional Transit will be equipped with rooftop solar panels by the end of this year. The completed project will generate enough electricity to meet the energy demands of the depot. The first phase of the project is expected to begin producing energy by October this year.[17]

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TEXT: ALEXANDER FARNSWORTH **PHOTO:** WÄRTSILÄ

FISHING FOR EFFICIENCY

Wärtsilä's fish-eye view of the global fishing market and thousands of hours of development work have resulted in a better and more efficient stern trawler.

solution

"STERN TRAWLERS CAN BE OUT FISHING FOR UP TO 350 DAYS A YEAR SO FUEL CONSUMPTION IS, THEREFORE, AN EXTREMELY RELEVANT CONSIDERATION."

The propulsion system of the new stern trawler is based upon the Wärtsilä 31 engine.

Although the practice of fishing dates back at least 40,000 years, the development of new technologies continues to advance the industry. In the last two centuries, vessels have gotten substantially larger and more complex, incorporating the ability to properly store and even process fish on board.

Purse seiners/pelagic trawlers are high-tech vessels normally used for fishing of species like herring, mackerel and whiting. The fish are pumped from the net on board the vessel for storage in refrigerated seawater tanks or processed in an onboard factory.

Stern trawlers, another type of advanced fishing vessels, drag nets out at sea to catch primarily bottom white fish and tooth fish. They operate 24/7 and year-round so all design improvements to lower fuel costs have a strong effect on the profitability of operations.

Wärtsilä's new, optimised stern trawler design will reduce fuel consumption and notably increase overall vessel efficiency compared to currently available designs. The propulsion system is based upon the Wärtsilä 31 engine, which has been recognised by Guinness World Records as being the world's most efficient 4-stroke diesel engine.

"Stern trawlers can be out fishing for up to 350 days a year so fuel consumption is, therefore, an extremely relevant consideration. Our new design features the very latest technologies and has been developed to offer the fishing industry lower fuel costs and greater possibilities for profitable operations," says **Ove Wilhelmsen**, GM Sales, Fishing Vessels and Managing Director, Wärtsilä Ship Design Norway.

MORE EFFICIENT OPTIONS

The Wärtsilä 31, medium-speed, 8, 10, 12, 14 or 16-cylinder, 4-stroke engine is available in diesel, dual-fuel or pure gas versions, and has the world's highest fuel consumption efficiency of any engine, clocking in at 165 g/kWh, and has a power range requirement from 4.2 to 9.8 MW.

"The marine industry is focusing more than ever on efficiency and flexibility. The validation of the Wärtsilä 31 as being the most efficient four-stroke diesel engine in the world speaks for itself. When this is combined with

PURE MAGIC

The launch of Wärtsilä's new stern trawler was promoted by a few humorous videos. In them, Scottish and Norwegian fishermen delve into shop talk about the new Wärtsilä 31 engine, like the following:

"I was down at the pub the other night... I saw a brochure from Wärtsilä about a better boat, their new trawler...It was pure magic!"

For a sneak peak of the new design – and a good laugh – go to YouTube to watch the two videos: bit.ly/2eil5D8 (Scottish version) and bit.ly/2fAgAa5 (Norwegian version).

advanced hull design optimization in a holistic system integration approach, ship owners and operators now have a more efficient option for improving vessel operations and reducing costs. The Wärtsilä 31 clearly redefines efficiency," says Wilhelmsen.

Besides the new Guinness World Record-breaking engine, Wärtsilä's offering includes a new 2-speed gear system allowing for greater propulsion efficiency and hybrid fuel operation, as well as a single-propeller hull design.

"Cost savings of EUR 1 million are not impossible to achieve with greater fuel efficiency," says Wilhelmsen, adding how such 40-man-strong trawlers can typically cost between EUR 20–40 million to build, and are usually built at shipyards in Norway, Denmark, Poland, Turkey or Spain.

"We know the particular needs of the offshore fishing industry quite well," comments Wilhelmsen. "There are several thousand fishing vessels in the world, and over the next 10 to 15 years many of these will need to be replaced. So the trawler market is very interesting for us."

"COST SAVINGS OF EUR 1 MILLION ARE NOT IMPOSSIBLE TO ACHIEVE WITH GREATER FUEL EFFICIENCY."

KEEPING PACE WITH THE PROGRESS

As the world's fleet of fishing vessels continues to turn over, there will be increasing emphasis on measures to minimise the effect of fishing activities on the marine environment. These measures include the selection and application of appropriate technologies on board, such as those that minimise the emissions produced by the vessels and that employ energy efficiently during the operation of any applied technologies on board. Through this process, Wärtsilä technologies will be keeping pace with the progress.

A case in point is Rav the first of many new purse seiner/pelagic trawler combination vessels, which is being built by Danish yard Karstensens Skibsværft for Norway's Peter Hepsø Rederi. Expected to be delivered in October 2018, Rav will incorporate the latest Wärtsilä technologies in engine, battery and gear-box design and is set to be one of the most efficient fishing trawlers in the world.

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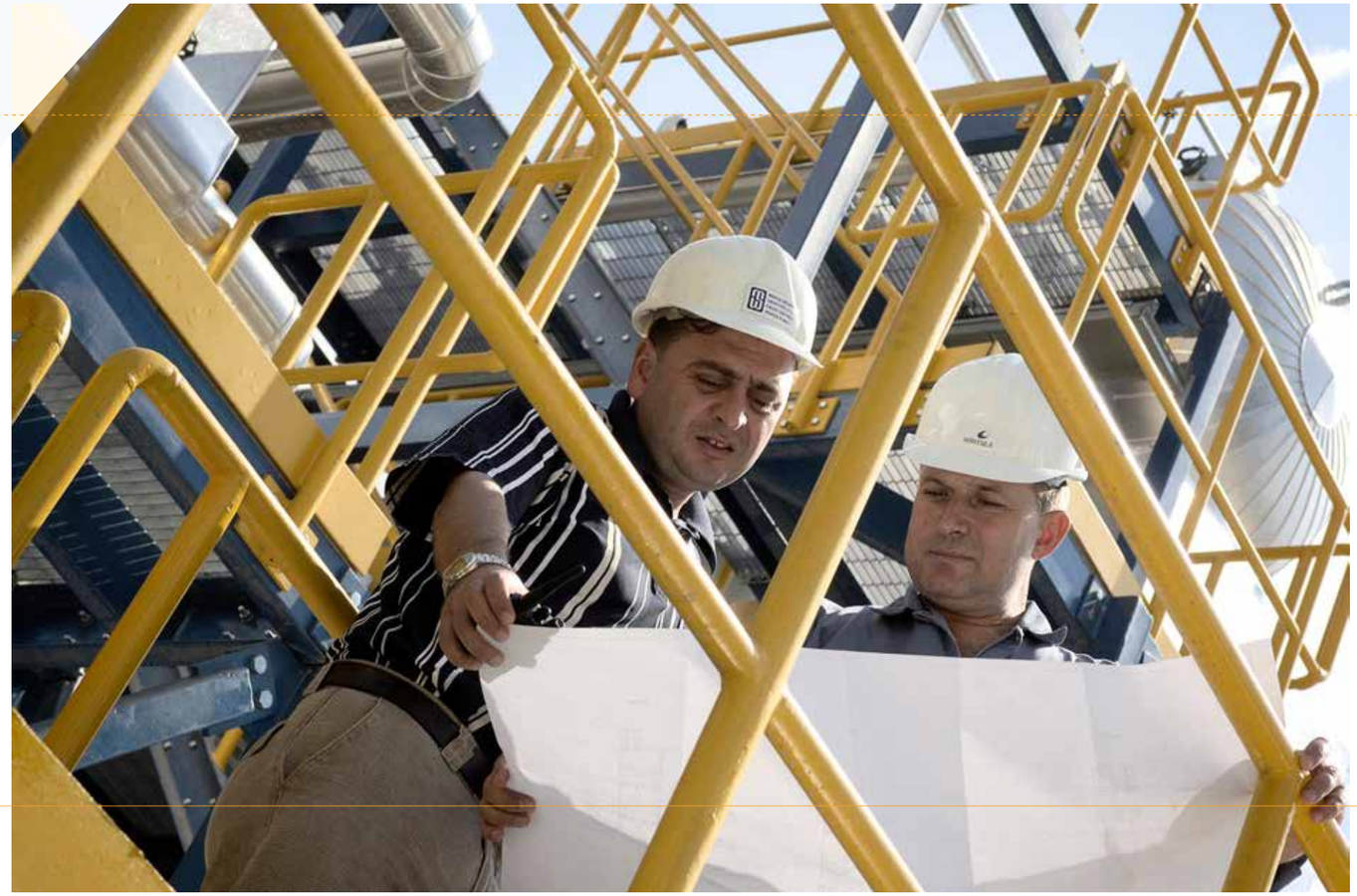
ENSURING PROJECT SUCCESS

TEXT: MICHAEL LEVITIN **PHOTO:** WÄRTSILÄ

WÄRTSILÄ IS FAMOUS for its power plants, but its lesser-known project services also play a key role in the business. Productisation of Wärtsilä's Project Services, by Energy Solutions, promotes the visibility of these important resources.



"WÄRTSILÄ HAS SUPERIOR MACHINERY, BUT WE ALSO HAVE TRAINED PROFESSIONALS TO INSTALL AND DELIVER IT."

Although Wärtsilä is traditionally known for its technology and solutions, the company has been selling project services for decades. Wärtsilä's Energy Solutions has over 25 years of project experience in about 100 countries, and the scope of supply ranges from basic equipment delivery to full EPC (Engineering, Procurement, Construction). "We have completed over 500 EPC projects and delivered over 4700 power plants. Our track record is good and shows clearly our experience in the business," says **Janne Tarsa**, General Manager, PM Development. Wärtsilä Energy Solutions recently implemented a productising project to highlight the important role of project services and better explain the value of these services to customers. As a result, there is a newly defined set of service products.

A SEQUENCE OF CUSTOMER BENEFITS

Project services and project management are a linchpin in Energy Solutions' success. To customers, they offer more value: predictability, speed, scope flexibility and competitive delivery times. Experienced personnel and project management know-how are essential elements in predictability – in other words ensuring that a project is delivered on time, safely and in compliance with regulations.

Wärtsilä's professional project management is committed not only to Wärtsilä's own best practices but also to Project Management Institute (PMI) certificates and International Standards Organization (ISO) best practices for project work. "For customers, it's important that the project runs smoothly and properly. Our professionals are highly experienced and trained for project work. We strongly encourage our employees to have these PMI certificates as we value this highly," explains Tarsa.

Predictable projects reduce customer risks and even assist customers in obtaining financing. Moreover, competitive delivery times contribute to earlier access to the market. "For example, when a customer wants to speed up the delivery time of a power plant, Wärtsilä has a concept for fast-track projects. This means that project work can start with a preliminary agreement with the customer before the actual contract has been signed, and after that, multiple activities run parallel to shorten project duration," explains Tarsa. Predefined scopes help customers in decision-making, and several scope package options ensure the optimal scope of supply for each customer.

WHY PRODUCTISATION?

Wärtsilä wanted to better show the value of project services for customers. A typical EPC project consists of 50% equipment and 50% project services. The newly defined services help customers understand the role of each service component.

"It is important to recognise the role of the services. Wärtsilä has superior machinery, but we also have trained professionals to install and deliver it. The success of the whole project is in the hands of these services, which are the backbone of a project," says Tarsa.

The newly defined services include project management, engineering, procurement, logistics, installation and construction management, site adviser and commissioning services. All service areas are interlinked with one another and supported by modern information management tools.

The defined project services make it possible to explain to customers what exactly is included in the project services. It is easier to fulfil customer expectations when both the supplier and the customer have a clear picture of the project.

WIDENING TO OTHER BUSINESS LINES

The productisation project already has helped in sales offerings, pricing and in clarifying responsibilities between suppliers and customers. Currently, sales personnel are being trained further, and by the end of the year, their portion of the training will be complete. "We have collected feedback, and it confirms that working with defined services has eased sales work. This is just the beginning because we are widening the productisation of project services for other business lines as well," Tarsa explains.

The defined project services are designed for traditional engine power plant projects. The growing business in liquefied natural gas (LNG) and renewables also requires defined project services. "In a solar power plant, or in a hybrid (solar and engine power) plant, there are slightly different kinds of challenges, compared to an engine power plant. We have already started the productisation process for solar so that Wärtsilä can aim to provide even better service in the business," sums up Tarsa.

TAKING THE HEAT

TEXT: MICHAEL LEVITIN (WITH HAIDAR MOHAMMAD AL HERTANI) **PHOTO:** WÄRTSILÄ

FEW PLACES ARE as challenging for efficient energy use as the harsh desert climate of Saudi Arabia, but new Saudi "2030 Vision" regulations are demanding just that. So the Yamama Cement Company turned to Wärsilä to build a new Flexicycle power plant that can use excess exhaust heat to generate even more electricity.

Representatives of the Yamama Cement Company and Wärtsilä during contract signing.

Contributing significant energy generation for Saudi Arabia's cement sector is a new 160 MW Flexicycle power plant, a full EPC (Engineering, Procurement and Construction) project for Yamama Cement Company in the capital Riyadh. The first of its kind in the country and Saudi Arabia's largest-to-date engine plant installation, this lump sum turnkey (LSTK) project features 11 18-cylinder Wärtsilä 50DF dual-fuel engines with N+1 configuration. While its ability to operate on natural gas with light fuel oil and crude oil as a backup is nothing new, the plant's real benefit is the waste heat recovery system that will use excess heat from the exhaust to power a steam turbine and generate electricity, maximising the plant's efficiency, in accordance with new Saudi "2030 Vision" regulations requiring more efficient power use. What's more, the power plant will host the latest online Continuous Emissions Monitoring System (CEMS), promoting a competitive advantage in Saudi Arabia's stricter regulatory environment.

YEARS OF NEGOTIATION

According to **Haidar Mohammad Al Hertani**, Managing Director of Wärtsilä Saudi Arabia, the biggest challenge was securing the technical and commercial aspects of the plant through years of intense negotiation, while facing a field of aggressive competition. "The project is a continuation of Wärtsilä's successful record in Saudi Arabia, where we have more than 70% market share in the cement sector. This plant builds on that record and has been achieved due to Wärtsilä's emphasis on customer centricity: where customer interests and customer satisfaction come first," Al Hertani says.

Started in 1961 by **Prince Sultan bin Mohammed bin Saud Al-Kabeer**, mainly to manufacture and trade cement in Riyadh, the Yamama Cement Company is regarded as the oldest cement company in the central region, and the third largest in the entire kingdom. Yamama Cement Company, which is relocating its factory outside the boundaries of urban Riyadh, says production output from the plant will continue to exceed 20,000 tonnes of cement per day.

The company uses gas turbine units for the power plant operating its existing facilities. When Yamama started negotiations with Wärtsilä in 2014, it compared the viability of using gas turbines with Wärtsilä's internal combustion engines (ICE) technology. Ultimately it favored ICE, and after several years of negotiation, the contract was signed in June.

"During the feasibility stage, the most notable and achieved milestone of the project was favoring our Flexicycle internal combustion engines technology in an open competition with open cycle gas turbine (OCGT) and combined cycle gas turbine (CCGT) technology, in a traditionally gas-based Middle Eastern country," says Al Hertani.

A STRATEGIC PARTNERSHIP

Tender requirements were complicated and the operational conditions of working in Saudi Arabia are harsh, he adds. But Wärtsilä's proposal was the only one that complied with all of the customer's prerequisites – technically, economically and operationally. It also met the need for localisation, creating employment opportunities for Saudi citizens as well as sourcing equipment from local companies, adding a significant value chain to the economy by aligning Wärtsilä's objectives with the 2030 Saudi vision. "We were very flexible, trying to understand Yamama's needs, bridge the gaps and mitigate the risks that arose during negotiation," Al Hertani says.

As a full EPC project, Wärtsilä is responsible for handling all aspects of plant construction and delivery. Though the 160 MW project is normal-sized as power plants go, it represents a giant in the cement industry.

Calling the relationship a "strategic partnership," Yamama's General Manager **Jehad Abdul Aziz Al Rasheed** say, "Wärtsilä has a reputable track record in Saudi Arabia and they have offered an efficient and reliable solution for a harsh operating environment."

For Al Hertani, the successful deal reflects the hard work of Wärtsilä's team and its ability to adapt to challenging conditions. "I believe we have achieved this major milestone by collective team efforts, having the passion to do things right, customer centricity and entrepreneurial spirit," he concludes. "Our solution combines excellent efficiency with complete reliability and availability, with the highest return on investment compared with other solutions."

"OUR SOLUTION COMBINES EXCELLENT EFFICIENCY WITH COMPLETE RELIABILITY AND AVAILABILITY."

DREDGING GREENLY

▶ **TEXT:** RICHARD ORANGE **ILLUSTRATION:** WÄRTSILÄ

DEME'S FOCUS ON safeguarding the environment led to its decision to pioneer the use of greener LNG dual-fuel engines in dredgers.

Dredging is perhaps the most demanding task an engine can perform, so when the Belgian group DEME opted for Wärtsilä's 34DF dual-fuel LNG engines for the latest addition to its dredging fleet, it was a sign the technology had come of age.

But according to **Jan Gabriël**, the company's Head of Construction and Conversion, the main reason to fuel its new "Antigoon" class dredger "Scheldt River" with LNG was environmental rather than operational.

Compared to diesel, LNG has at least 20% lower carbon emissions, nitrogen (NO_x) emissions are reduced by approximately 80%, sulphur (SO_x) emissions are near eliminated. The engines produce virtually no soot.

"Emissions-wise this really is a game-changer," Gabriël argues. "It's part of the continuous quest of DEME to be environmentally friendly."

All dredgers operate close to shore, often in cities, ports and harbours, making their emissions highly visible to the public, but DEME's focus on LNG and dual-fuel engines differentiates it from its main competitors.

The company's stated vision is "to create land for a sustainable future." Safeguarding the environment is one of its five core values.

There is a commercial advantage to this environmental approach, too. Increasingly, DEME's government and corporate customers reward contractors who demonstrate that they can fulfil a contract with lower harmful emissions.

"Some really advanced schemes are being put into place that incentivise contractors who can do the work with less fuel consumption and less carbon dioxide production," Gabriël says. "If you are good at that, you can be slightly higher in price."

EXPANDING ECAS

Perhaps the most immediate trigger for DEME's decision was a tightening of the International Maritime Organisation's MARPOL Annex VI regulation for SO_x and particulates emissions for Sulphur Emissions Control Areas (SECA) at the start of 2015, reducing the limit to 0.10%.

This meant that shipping companies could no longer operate diesel fuelled dredgers with standard fuel in the Baltic Sea, the North Sea, North America and Canada, and the US Caribbean.

A new SECA was announced in China's Yangtze region in August, and SECAs are being considered for Singapore, and the Australian coast.

"We have analysed a number of other solutions, such as scrubbers, but we are not satisfied with the result," Gabriël said. "You are taking the sulphur oxide emissions out of the air but then – in the basic but approved installations, – depositing them in the sea, which for us is not a satisfying solution."

The other main solution, using low-sulphur marine fuel, would have meant higher fuel costs.

"When we made the decision at the end of 2014, there was still a serious gap between the price of LNG, in terms of net calorific value compared to the price of low-sulphur diesel oil. Now that economic case is a bit less pronounced, but we expect that to change."

Other drivers were technological and regulatory. In September 2014, Wärtsilä informed Gabriël that the company's dual-fuel engine was now capable of directly driving a centrifugal dredge pump.

Previously, LNG dual-fuel engines could not cope with the fast-load variations created by such pumps when, for example, a dredger's suction tube moves from dredging soft sand to a patch of heavy rock.

"For us, this was a key element, and up until then, it was not possible. So when Wärtsilä mentioned this to me, it opened up a new possibility," Gabriël says.

According to **Giulio Tirelli**, Director of Marine Engineering in Wärtsilä Marine Solutions, the change was a result of improvements in optimising the engine parameters, including the engine control.

"We had to tune the engine in a different way to enlarge the engine's operational field. We improved the automation system, the fuel injection system and fine-tuned some key components," he says.

SMOOTH SAILING AHEAD

The fine-tuned system involves monitoring the combustion in the engine more frequently and precisely, improving combustion control capabilities and allowing for more effective repetitiveness of combustion cycles.

Before committing itself, DEME put the new engine to the test in laboratory conditions that simulated the most demanding dredger operations. Then, after Wärtsilä carried out some final adjustments, they judged that the engine was sufficiently responsive.

"The engines are doing really well. So we are looking forward with a certain degree of confidence," Gabriël says. "After a few months of operations, we will know for sure. It would be naive to say there will be no problems, but after the intensive testing, we will not have serious difficulties."

The Scheldt River's design was made possible by the new set of rules the IMO brought in for gas-fuelled ships in June 2015, which permitted the gas tank to be located closer to the hull, allowing Royal IHC to design an LNG dual-fuelled dredger which did not depart too much from a standard dredger design. DEME ordered the ship in the spring of 2015.

The big draw-back from DEME's point of view is the shortage of places to refuel LNG vessels, with bunkering facilities at present existing in Sweden, Norway, Finland, Spain, and the US West Coast.

"Our decision was that we had to move forward and break through this chicken-and-egg issue," Gabriël says. "What we see is that things are moving. It's not developing rapidly enough in our view, but it is taking off."

By the end of this year, LNG bunkering will be possible at Zeebrugge in Belgium, and next year in Rotterdam in The Netherlands. Dunkirk in France is also planning a facility, and we expect to see facilities in Hamburg, and downstream of London.

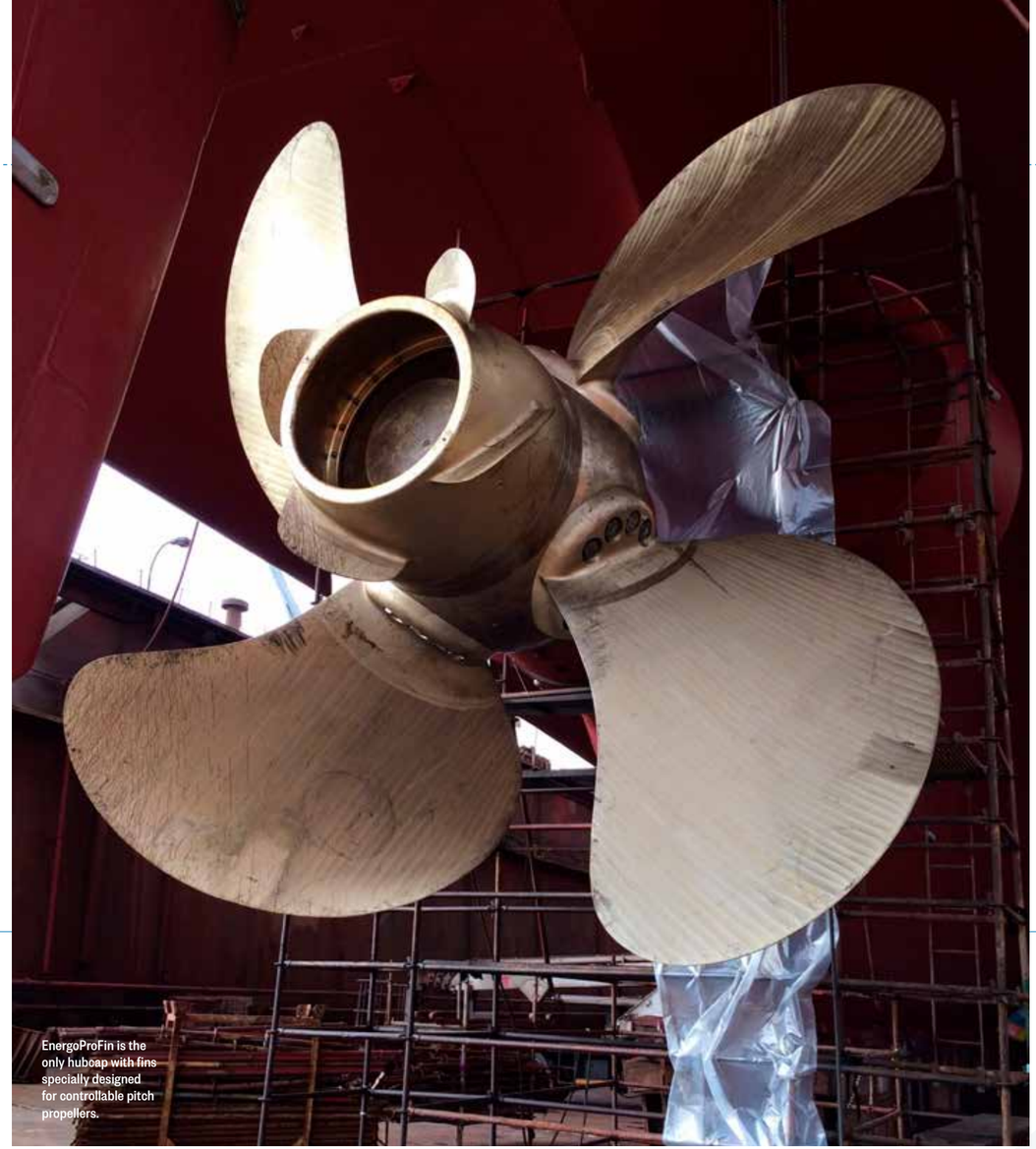
"We think we have made a good decision," Gabriël concludes. "It was not easy because we are the pioneers, but we believe in this solution, and we are now looking forward to our first experience in operating LNG vessels."

"EMISSIONS-WISE THIS REALLY IS A GAME-CHANGER. IT'S PART OF THE CONTINUOUS QUEST OF DEME TO BE ENVIRONMENTALLY FRIENDLY."

CHANGING THE GAME IN PROPULSIVE EFFICIENCY

▶ **TEXT:** STEVE ROMAN **PHOTO & LLUSTRATION:** WÄRTSILÄ

NEARLY ANY TIME we find a way to get more bang for our buck, we are keen. Especially in an ultra-competitive industry like shipping, any reduction in fuel consumption can translate to substantial cost savings for owners and operators, and it benefits the environment to boot. The industry's first hubcap and fin setup for Controllable Pitch Propellers is one such game-changing ticket to savings.



EnergoProFin is the only hubcap with fins specially designed for controllable pitch propellers.

One key to fuel savings is the efficiency of a ship's propulsion system. Because of various types of kinetic losses, only about 50–70% of the energy put into the shaft goes toward moving the ship forward. One challenge is rotational loss, when the rotating propeller pushes against the water and causes it to spin. Rotational loss consumes roughly 5% of the energy entering the system.

Placing a cap with fins aft of the propeller hub is one way to reduce rotational loss. The cap reduces the swirl, while the fins effectively catch and absorb the force of the rotating water, eliminating the vortex and feeding the energy back into the propulsion drive train.

Wärtsilä's line of such devices, the Wärtsilä EnergoProFin, has proven to be a highly attractive add-on as it boosts propulsive efficiency by a fairly consistent 2% at a reasonably low cost. However, this type of solution has historically been limited to use on Fixed Pitch Propellers (FPPs), where the pitch angle of the blades never changes.

The pitch for FPPs is optimised for energy efficiency in only one operating condition, such as the fairly constant sailing speed of a container ship. Other types of ships, notably ferries and fishing vessels, use Controllable Pitch Propellers (CPPs), where an actuating mechanism inside the hub can change the pitch depending on the operating needs, such as sailing, low-speed manoeuvrability or raw pulling power.

Due to all the mechanics they contain, CPPs have relatively larger hubs compared with FPPs. The resulting higher hub ratio means that they can produce a more intense swirl. Additionally, when a cap and fin device is used, the angle of the fins is designed to operate with a specific pitch angle. When the pitch is changed on a CPP, the angles of the fins and the blades no longer match. For these reasons, the prevailing view in the industry has been that recapturing the rotational loss in a CPP by using a cap and fin device simply would not work.

That view has now changed since Wärtsilä's Services Hydrodynamic and Mechanical Design Engineering team has developed a new type of Wärtsilä EnergoProFin specifically for CPPs that overcomes these challenges. It is already being used on two vessels.

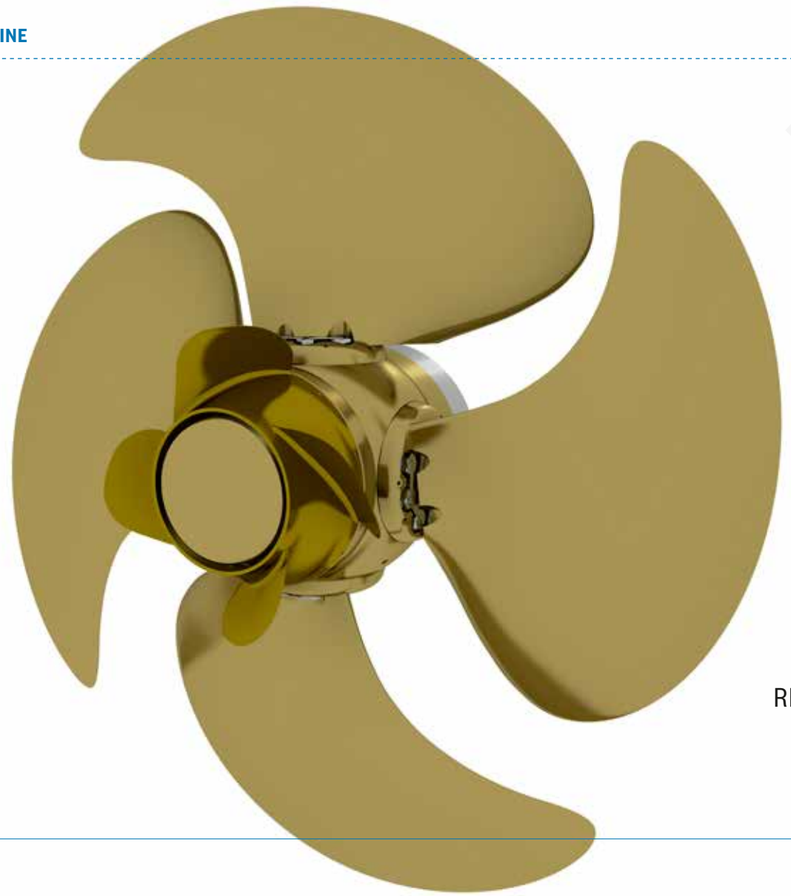
THE WÄRTSILÄ ENERGOPROFIN HAS PROVEN TO BE A HIGHLY ATTRACTIVE ADD-ON AS IT BOOSTS PROPULSIVE EFFICIENCY.

EYE-OPENING RESEARCH

The catalyst for this breakthrough was an EU-funded research project entitled GRIP (Green Retrofitting through Improved Propulsion), which was carried out from 2011 to 2015. Through this work, Wärtsilä and nine other European companies joined forces to resolve some of the fundamental problems in propulsion efficiency. Specifically, they were studying various energy-saving devices on the market to determine which worked and why, as these questions were not understood fully within the industry. The approach led the participants to take a hard look at the basic principles of the energy-savings equation.

With a deeper knowledge of hydrodynamic principles gained from GRIP, and the use of state-of-the-art computational fluid dynamics (CFD), the Wärtsilä team was able to use its experience in producing the Wärtsilä EnergoProFin to develop a solution for CPPs.

However, testing the design presented challenges that are common within the shipbuilding industry. While it is possible to shrink the ship and its hardware to model size for testing in a modelling tank, it is never possible to scale down the properties of the water, such as density and viscosity. Therefore,



THE DEVICE CAN BE MOUNTED ON BOTH NEW-BUILD AND RETROFIT PROPELLERS.

full-scale tests are preferable in theory, but dynamic conditions at sea make comparative tests impossible, even if the high cost of such tests were not a factor.

Instead, the development team took the best middle-ground approach, using a combination of full-scale and model-scale CFD computations. The CFD computations at model scale were compared to the results coming from the relatively accurate modelling tank. Because the CFD calculation methods were correct at the model scale, the engineers could be confident that they would be accurate at full scale as well.

Computer modelling was also employed during the design phase to optimise castability and minimise the chance of flaws in the structure of the finished product.

All this hard work resulted in the CPP-compatible Wärtsilä EnergoProFin. This new type produces roughly equivalent efficiency gains as the FPP version, though there is more variation depending on the specifics of the individual propeller. At the upper end of the range, gains even exceed 4%.

Compared to the design for the FPP, a distinctive feature of this version is that the hubcap is open at the aft end. As the hub aft is already seawater resistant, the open end does not affect performance. To maximise efficiency gains, the angle of the fins is optimised for the pitch setting that the ship will be using most.

While gains will be highest at that pitch, it is important to note that there are gains at other pitch settings as well. In other words, even with up to 12 degrees' difference in pitch, there is still a positive effect.

The device can be mounted on both new-build and retrofit propellers, though integrating it requires specialized expertise from Wärtsilä engineers. It should be noted that, while the Wärtsilä EnergoProFin for FPPs can be used with competitors' propellers, the current EPF-CPP model can be fitted only onto Wärtsilä propellers with a 4C-3A(O), 4D or 4E hub. The possibility of installation on other (including third party) hubs is under investigation.

ASSESSING THE BENEFITS

Development of the CPP model of the Wärtsilä EnergoProFin marks a real achievement for everyone involved. It also serves a testament to the efficacy of joint industry research projects like GRIP and to the power of recent advances in CFD.

The greatest significance of this device is in the sizable energy savings that it can bring to individual operators looking for practical ways to minimise costs and emissions. As information about the new energy-saving option spreads among ship operators, more of them are likely to take a closer look at their fleets' energy profiles to assess ways to incorporate this new technology into their propulsion systems, and this change can have a positive effect on the efficiency of the shipping industry as a whole.

Meanwhile, Wärtsilä's engineers will continue to work to make these important energy-saving devices compatible with a wider array of ship and propulsion designs to bring the benefits of lower fuel costs and lower emissions to more customers.

PHOTO: iSTOCK

Everything's getting greener in Texas

The City of Denton, Texas, has an ambitious goal: to increase their renewable energy from 40% to 70% by 2019. But because of the fluctuations in the supply of wind and solar, Wärtsilä's internal combustion engine technology will be used to balance the output.

Wärtsilä has signed a major contract to supply a 225 MW Smart Power Generation plant to Denton Municipal Electric, the locally owned utility for the City of Denton. The plant will provide reliable power to the city's industrial, residential and commercial consumers with 78% lower emissions and a lower cost. What's more, Wärtsilä's solution will save over two million gallons of water weekly (compared with a similar-sized gas turbine), a key feature in a state that deals with drought and rationing during the summer season.

*Sign off

TEXT: ANNA GUSTAFSSON **PHOTO:** JOHANNES TERVO

[AT YOUR SERVICE]

Letting environmental solutions drive innovation

IT ONLY TAKES A FEW SECONDS for **Juha Kytölä** to get excited while talking about his work as Vice President in charge of environmental solutions at Wärtsilä Marine Solutions. Kytölä joined Wärtsilä in 1989 and has been working for the company ever since. His first title: noise and vibration engineer. After working in engine development and manufacturing for years, Kytölä is now immersed in the world of environmental regulation and innovations.

1 CAN STRICTER ENVIRONMENTAL REGULATION WORK AS A DRIVER FOR INNOVATION?

At Wärtsilä, we have always focused on innovation and new technology. We invest a lot in research and development to come up with technologies that provide the best efficiency to the customer and optimise their operations sustainably. We develop products like exhaust gas scrubbers and catalysts that reduce local air emissions. In addition, from an industry standpoint, we concentrate on reducing CO_2 emission levels. Most of the innovations we have are within the technologies themselves. For example, in reducing water emissions, we focus on wastewater cleaning in ships. We actually created technologies that purify water better and meet the same purification levels as in land-based water treatment plants. We also have effective, novel solutions where the streams of grey and black wastewater are treated separately.

2 WHAT KIND OF FEEDBACK DO CUSTOMERS GIVE?

We see many areas where our customers are affected by stricter environmental regulation, which sets boundaries for their businesses. We try to look at the big picture from the ship operator and owner´s point of view and see the whole lifecycle of a ship, instead of looking solely at one installation or solution. We understand how the ship develops when a new system is implemented and installed. So we look at how each technology or innovation impacts the other solutions on board. This is a great opportunity for us. We are involved in so many technologies, starting from ship design and automation. In many areas, we have been able to **deliver technology that helps customers save costs, which enables them to continue their operations and minimise the impact of their business on nature.**

3 WHAT KEEPS YOU MOTIVATED?

This is a great and inspiring world to work in. I am not speaking only about myself, but of all my colleagues around me. We truly see the purpose of the work we are doing and how our work supports the sustainable development of shipping.

Recently, I have been travelling a lot to meet our customers. I visited several shipyards in South Korea, China and Europe to discuss their views on environment and sustainability. I am extremely pleased that wherever I go, the shipping industry is taking environmental aspects into account. In every shipyard I visited recently, they were very well aware of the oncoming regulation so it was easy to discuss and understand their priorities. I didn't have to start from scratch to explain why this is important and convince them. Already they are prepared in every area and not only know the currently existing legislation but also are looking far into the future.

"SUSTAINABILITY IN SHIPPING CAN ALSO MEAN COST EFFICIENCY FOR THE CUSTOMER."

[CLASSIC]

Bright & Groovy

The 'lava' is a mix of wax-based and water-based liquids whose exact formula is a proprietary secret.

A 35W halogen reflector bulb heats the liquid, changing its density and viscosity to create the famously psychedelic light show.

Sales of the niche, retro item once again skyrocketed after 1997 thanks to the release of 'Austin Powers: International Man of Mystery'.

The lamps appeared on the British cult sci-fi TV shows 'Dr. Who' and 'The Prisoner'.

Original producer Mathmos still fills each bottle by hand just as it has since 1963.

Inventor Edward Craven Walker's original claim to fame was making underwater nudist films.

ORIGIN

Nothing embodies the spirit of the 'swinging 60s' quite like the lava lamp. The design classic got its unlikely start when British accountant **Edward Craven Walker** visited a London pub and became enthralled by an egg timer fashioned from hot blobs of oil floating in a glass cocktail shaker. His 'Astro Lamp', as it was originally called, went into production in 1963 and went on to become the defining relic of its decade.

TECHS & SPECS

Dimensions
Height: 43 cm
Weight: 2.95 kg

Production
1963–present

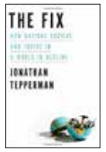
Materials
Polished aluminium, glass, coloured wax

[CULTURE WATCH]

[SCIENCE]

Extreme microbes living deep within gold mines might be munching on cosmic rays, a study by the Blue Marble Institute of Space in Seattle has found. Researchers discovered that extreme bacteria on Earth can survive solely off of ionizing radiation, which penetrates far underground. It's possible, they say, that microbial life on Mars or on even rogue planets could thrive the same way.

[LITERATURE]



With so many doom-and-gloom headlines about the state of the world today, it's refreshing to see the optimism offered by *The Fix: How Nations Survive and Thrive in a World in Decline* by *Foreign Affairs* magazine editor **Jonathan Tepperman**. The meticulously researched work tells the mostly overlooked stories of risk-taking political leaders around the globe and how they've overcome seemingly insurmountable challenges.

[TECHNOLOGY]

Forget mood rings. Researchers at MIT have developed a device that can guess a person's emotions with 87% accuracy by bouncing wireless signals off of them. Dubbed EQ-Radio, the setup uses the reflected signals to measure breathing and heart rate. Its inventors say it could be used in health care to predict when patients are getting depressed or to allow filmmakers to gauge audience reaction in real time.

TEXT: RICHARD ORANGE **PHOTO:** iSTOCK / MIKE LANEA

[AMBITION]

Taking the bugs from the ballast

With the Ballast Water Convention finally ratified, regulations to enforce the use of ballast water treatment systems can help tackle the problem of invasive species.

Whether it's the North American comb jellyfish devastating the Black Sea fishing industry, Chinese mitten crabs accelerating erosion in the Thames estuary, or zebra mussels from Bulgaria clogging up the water intake of US power stations, invasive species are a huge global problem.

At any time, the world's merchant ships are carrying different species in their ballast tanks, sucking them up whenever they take on ballast water, and then releasing them on the other side of the world.

"It can have a massive effect of the ecology of an area," says **Joe Thomas**, Wärtsilä's director of Ballast Water Management Systems. "It's been identified as one of the biggest threats to the world's coastlines."

The annual cost in terms of increased maintenance, destruction of fishing stocks, blockage of industry inlets, erosion and other issues, comes to EUR 12 billion per year in Europe alone, according to figures from the European Union.

Thankfully, a full 12 years after the IMO's 2004 Ballast Water Convention first was signed, and 120 years after steel vessels made ballast water necessary, regulations are coming through to combat the problem.

In September, when Finland ratified the convention, it added enough to the total tonnage of vessels from ratifying countries to surpass the threshold required – at least 35% of the total tonnage of world's merchant fleet – to bring the convention into force.

Beginning 8 September 2017, every ship above 400 Gross Registered Tonnes (GRT) – an estimated 34,000 ships – will have to install a type-approved ballast treatment system at their next mandatory IOPP survey, often coinciding with a vessel's five-year dry-docking inspection cycle. Thomas estimates the "massive demand" will require an investment between EUR 12–13 billion.

"The ratification is a very big milestone," he says.

ONCE AN ALIEN SPECIES is introduced, it is almost impossible to eradicate. Often, the best solution is to introduce a predator that can keep it under control, but that can pose other challenges. So, with alien species continuing to establish themselves in ecosystems across the world, Thomas stresses that it is still worth trying to control their spread.

"Yes, it's been happening for a long time, but it's going to continue to happen, and the ecology will continue to change unless we take steps to arrest it," he says. "There are real benefits in doing something rather than nothing. If it's not addressed, then we will continue to see this ever-changing profile."

To meet IMO requirements, a ballast system should treat all ballast water on uptake to minimise the transfer of alien species.

Unlike most of the competition's solutions, Wärtsilä Aquarius ballast water management systems hit the problem from two sides, using both ultra-violet (UV) and electro-chlorination treatment solutions.

THE UV SYSTEM IS most economical for ballast pumps with a capacity of less than 1000 cubic metres per hour, and the electro-chlorination system is most cost-effective for those with a capacity above 1500 cubic metres per hour.

The Aquarius range of ballast water management systems does not attempt to adjust the level of ballast water treatment, as the quality of water being pumped on board varies, but instead relies on a fixed dose aimed to be sufficient to ensure compliance with the regulation.

"Our approach from the very beginning really was more conservative, I guess," Thomas says. "We fixed our dose rates at a higher level so that control complexity was minimised. Our focus has been on compliance as well as making sure the customer has peace of mind."

Wärtsilä's experience has led it to try to make the system as simple as possible. "When you need to treat the ballast water, you absolutely need the ballast water treatment system to work, and if it doesn't work, it's a big problem," he explains.

Over the last few years, in anticipation of the ratification, new vessels have increasingly been fitted with ballast water management systems, often using designs that have rarely been properly put to the test.

"Many of those effectively are not used at all," he points out. "I cannot say whether they're maintained correctly and in accordance with the OEM guidance, but it may be that, when they're switched on in earnest, some significant problems could occur."

As the world finally begins to tackle the problem of ballast water, Thomas hopes the advantages of Wärtsilä's approach will be obvious. "Our approach has been one of partnership with the customer from the beginning. We help him choose the right technology, make sure the system is robust enough to comply with the regulations and provide global service support for maintenance," he concludes.

[TRAVELLERS' GEAR]

Make cold toes a thing of the past with the **ProFLEX Heavy Duty Heated Insoles** from ThermaCell. The water-resistant, battery-powered cushions are controlled via your smartphone and pump out up to 8.5 hours of toasty warmth.

Touted as the world's first fully collapsible smart carry-on, this stylish **travel case from Barracuda** not only slims down to fit under your bed, it comes fully loaded with USB charger, Bluetooth tracking and laptop tray. It even has dual cup holders to let you share coffee with a buddy.

Wondering what's happening back home? Logitech's app-enabled **Circle wireless security camera** lets you play spy from anywhere around the globe with live 1080p HD video, motion sensors and night vision. Use its talk function to nag your kids or confuse your pets.

TEXT: STEVE ROMAN

[LITTLE ENGINEER]

Never bored with cardboard

KIDS MUST PLAY WITH CARDBOARD BOXES. It's one of the unwritten rules of childhood, right up there with the requirement to jump into puddles and pop bubble wrap. We all know the drill: A small box becomes a knight's helmet. A fridge-sized box finds new life as a castle or a spaceship.

Paul Justin, an industrial designer based in Melbourne, Australia, hit on the idea of expanding the potential of this kind of creative play with a few engineering tweaks. The result: Makedo, a construction tool system that helps little engineers build imaginative and useful creations using whatever recycled cardboard they can find.

The toolkits are simple and require zero instruction. They come with a set of reusable, plastic 'scrus' of two different lengths, a 'scrudriver' and a patented 'safe-saw' that lets tykes cut through the cardboard without using anything sharp. Various sized toolkits are available from Makedo's certified carbon-neutral website – the only difference is the number of scrus.

Visitors to the website will find pictorial instructions for a number of builds – everything from shark costumes to Christmas trees. They can also see videos of construction tips and tricks, and even download 3D printing files to make hinges and brackets for more complicated designs.

Parents looking for a more ready-made solution should seek out the Makedo Ready-to-Build kits sold by third-party vendors like Amazon. These come with absolutely everything needed – decorated cardboard included – to build dinosaurs, space pods, puppies and the like. Recommended for ages 4 and up.

PHOTO: JUKKA RAPO

A new digital recipe

AS WÄRTSILÄ'S NEW CHIEF Digital Officer, my primary focus is to facilitate, coordinate, manage and accelerate Wärtsilä's digital journey. My role is not about creating a large, centralised digital function but rather about making all of the company digitally enabled so that 'digital' becomes infused throughout our cultural and corporate DNA.

Digitalisation at Wärtsilä still needs a clear definition, but at its simplest level, we must change how we innovate, identify and develop new solutions and services. These processes must be based on data, analytics, customer insight, innovation and cyber security and take place at a pace and in an agile manner that delivers results.

I look at my role a bit like that of a 'digital head chef.' Many of our ideas and digital initiatives are akin to ingredients. I'm starting my work with a wide variety of ingredients already in the kitchen cupboard and a talented team of other chefs ready to experiment and innovate.

We have enough of some ingredients but perhaps not of others, and some we may not need at all. But Wärtsilä's market position, install base, brand, reputation, engineering expertise, supply chain, technology maturity and operational excellence are all key staples. We may not have the final recipe just yet and probably have to test some ideas – and even accept that some versions might fail – before we perfect our Wärtsilä digital recipe.

So for the next eight to 10 weeks, I will be conducting a sort of inventory of our skills, capabilities, and digital appetite, by listening to and learning from colleagues, customers, partners and competitors. I will look at why we do what we do and what would happen if we changed it.

What is core to our digital journey that we need to protect and leverage? How can we amplify what we do brilliantly and support what we need to improve? What capabilities do we need to make that happen? How can we accelerate the journey and make sure it delivers commercial returns?

As our success depends on the partnership and collaboration of our customers and suppliers, I would love to hear about any burning issues you may have and what Wärtsilä can do to make it easier to do business with us. Please email me with your thoughts about how to make our digital offering more relevant, more accurate and proactive in meeting your needs. I look forward to including you in creating a clear digital recipe for tomorrow.

Marco Ryan
Chief Digital Officer
marco.ryan@wartsila.com
twitter: marcoryan

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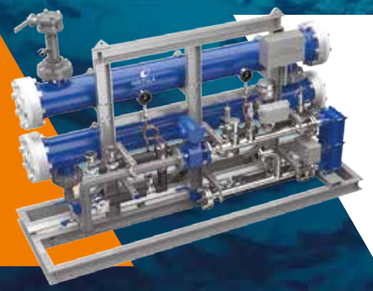
ENVIRONMENTAL COMPLIANCE ENSURES THAT YOU HAVE A GLOBAL PASSPORT TO TRADE.

WE HAVE THE RIGHT **BALLAST WATER MANAGEMENT SYSTEM** FOR ALL SHIPS, INCLUDING YOURS.



WÄRTSILÄ CONNECTS THE DOTS

Wärtsilä have the solutions you need to ensure environmental compliance – and opportunity to operate wherever you want. We help you find the right Ballast Water Management System for your individual needs, offering both Wärtsilä Aquarius UV and Wärtsilä Aquarius EC. Let Wärtsilä connect the dots that make your life both more profitable – and relaxing. Read more at www.wartsila.com

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