Twenty four7.

Wärtsilä Stakeholder Magazine

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*Wärtsilä Stakeholder Magazine**

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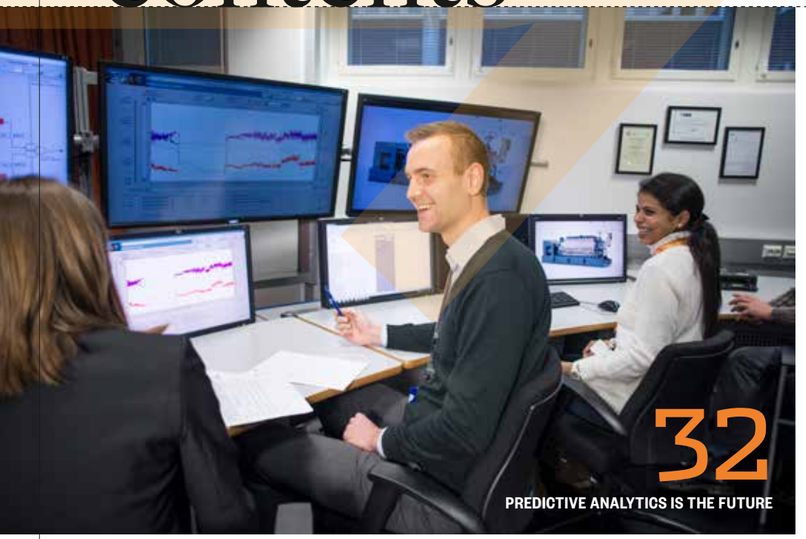

Around the globe

Sign off

in detail

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The need is speed

THERE ARE DAYS WHEN I dread opening up the morning paper or scanning the news channels, worried about what fresh catastrophe the world might be facing. And so far, the start of the new decade has not failed to disappoint.

From vast forest fires to continuing news of erratic weather phenomena and extinctions of rare animals and plants to ever more dire reports from scientists – the sense of doom and gloom is pervasive and almost overpowering. It may become tempting for us to give up and give in. But that is the wrong attitude. If anything, these events underscore just how much faster we need to work to save our planet. The changing climate touches everyone and everything; thus, the need of the hour is momentum.

In this issue of Twentyfour7., we share with you the stories of nations and industries that are working on solutions to tackle the challenges caused by global warming and climate change. You'll read about the futuristic technologies that are being deployed to provide sustainable and reliable energy for the nearly 10 billion people that will live on our planet by 2050. You'll also read about how emerging economies in Africa have been presented with the enviable opportunity of leapfrogging over the fossil-fuel energy era and include clean energy in their national grids.

Meanwhile, investors and corporations are using their financial muscle to invest in socially responsible ventures and business models. As a result, the adoption of digital tools like artificial intelligence and machine learning to improve efficiencies has increased across industries. In fact, in this issue, you'll read about how one company is modernising its fleet of nearly 600 vessels. This is one of the largest digitalisation agreements in maritime history ever, leading to significant environmental benefits.

What does all this show? The solutions we need to implement to tackle our world's problems exist and are being deployed. What we need right now is to ensure that this momentum does not falter. The only way to do that is to include more stakeholders in the conversation, to increase the adoption of smart technologies and to work together in building a more sustainable society. This is what we, at Wärtsilä, consider our purpose and something we strive towards every single day.

With that in mind, I hope you find the contents of this magazine thought-provoking and heartening and that you will join us in creating the momentum needed to live life more sustainably.

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WÄRTSILÄ

BUILDING PATHS TOWARDS A 100% RENEWABLE ENERGY FUTURE

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*around the globe

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

[AROUND THE GLOBE]

Piecing together the story of Arctic ice

ON 20 SEPTEMBER 2019 scientists from 20 countries departed Tromsø, Norway for a year-long expedition to study polar ice. Unlike previous projects researching the Arctic, the team on the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) expedition will examine the changes taking place in the Arctic ecosystem by actually living within it. Their vessel, the German-flagged Polarstern, which was retrofitted by Wärtsilä, has attached itself to an ice floe and will drift with it as it moves through the Arctic. The expedition intends to study the Arctic as the epicenter of global warming and gain fundamental insights that will help better understand the impact of climate change.

News

NEW HORIZONS FOR HYBRID TECH IN MARINE

Wärtsilä and Chinese state-owned shipbuilder CSSC Huangpu Wenchong Shipbuilding Company Limited signed a five-year strategic development agreement on 3 December. The agreement, signed at the Marintec Conference and Exhibition in Shanghai, is designed to realise the vision of a hybrid-powered dredger, but could extend to further projects in the future. It will also allow for the building of a cooperation framework and working mechanism for the research and development of hybrid power systems. To that end, Wärtsilä will support Huangpu Wenchong with technological innovations, system selection, performance calculations, and long-term services throughout the design and construction phases.

"Collaboration with industry partners is at the very core of Wärtsilä's Smart Marine approach to raising efficiencies and eliminating waste throughout the shipping sector. The agreement is one more example of this philosophy, and we look forward to cooperating with Huangpu Wenchong to create hybrid-power vessels that will benefit the industry by lowering costs, and benefit the planet by reducing greenhouse gas emissions," says **Henrik Wilhelms**, Director, Offshore and Special Vessels at Wärtsilä.

EXCITEMENT
RESPECT AND TRUST

ENERGY
MAKE THINGS HAPPEN

DO THINGS BETTER
EXCELLENCE

Wärtsilä
GLOCAL
WATCH

FINLAND:
Wärtsilä and Q Power Oy, a Finnish pioneer in biomethanisation, have signed a cooperation deal that will accelerate the development and commercialisation of renewable fuels. The aim of the partnership is to globalise and expand the market in this field. "We are extremely happy and eager to work with Q Power to develop technology and concepts that help the world take concrete steps on the path towards 100% renewables," says Jaakko Eskola, President and CEO, Wärtsilä Corporation, shown left signing the agreement with Ilkka Herlin, a primary owner of Q Power.

WORLDWIDE:
Wärtsilä has joined 74 other companies in committing to the decarbonisation of deep-sea shipping and its energy value chains through the Getting to Zero 2030 Coalition. The partnership consists of the Global Maritime Forum, the Friends of Ocean Action, and the World Economic Forum, and is aligned with the most ambitious interpretation of the IMO's carbon emissions reduction strategy, as well as the latest relevant IPCC climate science. The company's ideal position within the marine and shipping industries allows it to spearhead the drive towards a new era of positive disruptive development alongside various coalition partners.

RWANDA:
In October 2019, the Project Management Institute, the world's foremost association of project professionals, recognised Wärtsilä as having devised one of 10 most influential renewable energy projects of the last 50 years. The recognition is related to the KivuWatt power plant in the Rwandan village of Kibuye. The 25 MW plant was delivered and installed by Wärtsilä as a complete engineering, procurement, and construction project five years ago. It operates on the shores of Lake Kivu and is powered using the Wärtsilä 34SG engine. The project marks a new era of positive disruptive development alongside various coalition partners.

ZEEDS SHIFTS CARBON-NEUTRAL SHIPPING INTO HIGH GEAR

TEXT: JELENA PRTORIC **PHOTO:** WÄRTSILÄ

Together with other marine industry leaders, Wärtsilä is leading the way towards a cleaner and more sustainable future for the shipping industry with the Zero Emission Energy Distribution at Sea initiative, or ZEEDS.

WHAT IF SHIPPING ROUTES were organised in the same way as highways – with ships docking at offshore stations to refill their reservoirs with clean fuel? What if there were no carbon emissions from the shipping industry and no pollution at the ports?

The Wärtsilä-led ZEEDS (Zero Emission Energy Distribution at Sea) initiative envisions this kind of future, in which an entire ecosystem of offshore clean fuel production and distribution hubs would be strategically deployed across the globe.

"The challenge today is really to decarbonise the shipping industry – that was the rationale behind our initiative," explains **Cato Esperø**, sales director at Wärtsilä Norway and the spokesperson for the initiative. "We invited other companies to partner with us so that we can share knowledge and competencies. This type of collaboration is necessary if we want a sustainable future for the shipping industry."

In addition to Wärtsilä, the initiative's initial partners include Aker Solutions, an offshore engineering and technology company; DFDS, an international shipping and logistics company; Equinor, a multinational energy company; Grieg Star, an international shipowner; and Kvaerner, a provider of engineering, procurement and construction services. ZEEDS has identified 46 potential future participants.

DESPITE BEING MORE ENVIRONMENTALLY friendly than air freight, maritime shipping still accounts for 940 million tonnes of CO_2 emissions per year. According to a recent European Commission report on ship fuel oil consumption, if the shipping sector were a country, it would rank sixth in the world in terms of the amount of emissions produced. Until now, the maritime industry has been lagging behind others in addressing emission reduction targets. The ZEEDS initiative, rooted in the decarbonisation target set out in the Paris Agreement, hopes to rectify this situation and switch the transition to carbon-neutral shipping into a higher gear.

Egil Hystad, General Manager – Concept Development and Integration at Wärtsilä Marine Business says that in addition to fleet transformation, the industry needs to address the logistics aspects of the shipping industry, starting from bunkering and distribution. "We realised the main challenge was to quickly establish the infrastructure that would be able to support the global fleet," Hystad adds.

THE INFRASTRUCTURE OF THE FUTURE (as imagined by all companies involved in ZEEDS) is composed of fuel hubs set up next to offshore wind turbines, built as two-level platforms. The energy produced by the wind turbines would be used to produce hydrogen from water on the first level of the platform; while on the second level, ammonia, a clean fuel, would be made from hydrogen and nitrogen extracted from the air.

Since its establishment, the initiative has emerged as a leading industry voice on zero emissions shipping, recognised for its visions on clean fuel infrastructure. Still, according to Esperø, ZEEDS has just started on a long journey. "We believe an industrywide collaborative approach is necessary to achieve emissions reductions to stop the devasting effects of climate change," he says. "We have made significant progress in a short time, but to move forward, we need firm commitments and collective action, from both the governments and industry."

ZEEDS partners will work towards those commitments at a partner workshop in Bergen in March and at a ZEEDS Summit planned for October.

[AROUND THE GLOBE]

[WORDS & NUMBERS]

USEFUL DEFINITIONS AND NUMBERS OF INTEREST.

PETAJOULE (PJ)
One thousand trillion joules of energy. 1 PJ is enough energy to power the Canadian city of Calgary's entire electricity grid for a year.

BAGGYWRINKLE
A soft cover for ship's cables that prevent the occurrence of sail chafing.

75%
In one year, the average container ship travels the equivalent of 75% of the distance to the Moon.

[TRENDS & SCENARIOS]

FUTURE PERSPECTIVES.

Make a mermaid your next Instagram pal

Sublue's new Mix Pro is an underwater scooter that allows you to travel under the water while also using your phone to capture images and video and upload them to social media while still submerged. Its dual motor system can propel riders along up to 1.8 metres per second at depths of 40 metres below the surface.

Ting Liu, the company's General Manager, says of the device: "Sublue devices enable everyone from casual beachgoers to seasoned divers to have amazing underwater adventures and explore in ways that only our technology will allow. The Mix Pro is incredibly light and compact for easy movement through the water with a number of features that let explorers see the ocean, or even their swimming pools, in new ways."

[CORPORATE CITIZENSHIP]

Wärtsilä, a corporate role model

TEXT: CHARLOTTE INGALLS **PHOTO:** WÄRTSILÄ

Corporate leaders around the world are taking a new look at what it means to be a good corporate citizen. Many of their recommendations are business as usual for Wärtsilä.

The Business Roundtable (BRT), an association of CEOs of U.S.-based companies ranging from Apple and Amazon to ExxonMobil and Mastercard, issued a new Statement on the Purpose of a Corporation in August 2019 which reads: "Each of our stakeholders is essential. We commit to deliver value to all of them, for the future success of our companies, our community, and our country."

While these words are generally being received as innovative and forward-thinking, for Wärtsilä it is very much a case of 'as you were'. Wärtsilä knows that the needs and demands of its customers are changing, with improved efficiency, innovation, and sustainability now in constant demand. Accordingly, the company has focused its efforts on optimising performance throughout the lifecycle of its solutions. Through the digitalisation of its services and a desire to push the industry towards a 100% renewable energy future, the company finds itself ideally placed to lead the conversation on corporate citizenship.

AN INDIVIDUAL AND COLLECTIVE RESPONSIBILITY

These aims and goals are by no means restricted to the boardroom, however. Every employee is part of the company's push to enable sustainable societies with smart technology. The constant desire to facilitate change is borne out through the company's R&D, which often works together with customers and, in some cases with competitors, to ensure a brighter future for both industry and the planet in general.

Indeed, all employees and communities of the company's 25,000 active suppliers are expected to uphold the same corporate citizenship standards as the parent company. These include:

- Compliance with all relative legislation;
- Operational safety for all personnel and facilities;
- Support and respect for human rights as defined in the United Nations Universal Declaration of Human Rights;
- At a minimum, have an environmental management system that complies with the International Standard 150 140001 or Economic Management and Audit Scheme (EMAS) latest edition.

FINANCIAL SUCCESS AND SOCIAL LONGEVITY

Natalia Valtasaari, Wärtsilä Vice President of Investor Relations, agrees that the BRT's new statement does not seem to be a radical shift, but rather a reflection of the trends within the financial community.

"Socially responsible investment was once a niche, but it is becoming the norm. Investors are starting to recognise that they can steer sustainability with their investments," Valtasaari says. "Investors are still first and foremost seeking long-term earnings progression, but now they see this comes from a company with a clear and compelling strategy for future success that includes strong social value propositions."

With awareness continuing to grow around global warming and social responsibility, Wärtsilä's financial success will increasingly be rooted in its ability to provide environmentally sound solutions to the marine and energy industries.

Wärtsilä is ahead of its BRT counterparts because delivering value to all stakeholders – from the employees to the customers, to the environment and industry partners – has been essential to how it thrives as a business. The BRT's new Statement of Purpose gives the company even more motivation to continue in this direction.

WÄRTSILÄ KNOWS THAT THE NEEDS AND DEMANDS OF ITS CUSTOMERS ARE CHANGING.

[COLUMN]

Cybersecurity
1.5 trillion reasons to take it seriously

IN 2020, THE COST of cybercrime is expected to reach USD 1.5 trillion dollars worldwide. This is an issue so imperative that it is overshadowed by only a handful of only the most serious global issues at present. While the marine industry may not seem like the most likely target, the growing automation of fleets mean that we also need to be more than aware of this threat.

Each January, the largest cybersecurity companies in the world use threat and trend information to predict changes in the cybersecurity arena for the coming year. Here are a few that are, in my opinion, of particular interest and concern.

Let's start with ransomware. It is widely expected to continue to evolve in complexity, becoming increasingly targeted and persistent in nature. While the evolution of the Security Operations Centre (SOC) and the Network Security Programme will go a long way in mitigating many automated attacks, the nature of the evolving threat ensures it remains a significant risk.

VULNERABILITIES KNOWN TO the corporation and workforce but unpatched will be exploited on a widescale basis. This will include corporate network systems, APIs, industrial IoT and critical infrastructure. Such exploitation can be guarded against with enhanced patching programmes. However, this is not effective where systems are using software no longer supported by developers. Cyber insurance, therefore, needs to be reviewed in relation to risks associated with lack of patching known vulnerabilities.

A further threat is that of skill shortages. Worldwide, it is estimated that we are half a million experts short when it comes to coping with the current problems, meaning we have to act. At Wärtsilä, we are combatting this by running programmes for interns and university students to show them what a career in the industry might look like and retraining people who either work in the IT sector or show an interest in the field.

THIS IS ALL THE MORE IMPORTANT in light of two critical advances that will change our digital world. The first is quantum computing, which has the potential to completely strip away each and every type of encryption known to man, changing the way we send data forever.

The second is 5G. We all know it is coming, but the ramifications could be huge. Already, everyday household items such as coffee machines and refrigerators are being hacked on a regular basis – imagine that type of threat on a much bigger scale and at 20 or 30 times the speed.

To combat such risks and safeguard ourselves, we need to start harnessing the power of AI in our favour – quickly.

MARK MILFORD
Vice President, Cyber Security, Wärtsilä

WE ARE HALF A MILLION EXPERTS SHORT WHEN IT COMES TO COPING WITH THE CURRENT PROBLEMS.

PHOTO: MARJA VÄÄNÄNEN

TEXT: LORELEI YANG **PHOTO:** 123RF & WÄRTSILÄ

CLOSING AFRICA'S ENERGY GAP

Experts are calling Africa the next bright spot in the global economy, with several African nations registering strong economic growth. However, for this trend to continue, the continent's energy supply and distribution grid must be modernised.

Cape Town, South Africa has experienced rolling brownouts and blackouts due to the local energy provider's failure to upgrade its generating capacity.

reportage

In 2017, NASA released a series of satellite images of Earth at night. The images breathtakingly illustrated the massive intercontinental disparity when it comes to lighting at night. Europe, North America, parts of the Middle East, and East Asia were well-lit whereas Africa, Australia, Latin America, and Central Asia are much dimmer.

In Africa's case, the lack of light reflects a sobering reality: over half a billion Africans have no access to electricity, and even more have access only to very expensive and intermittent electricity.

"South Africa is experiencing rolling blackouts and brownouts (drops in voltage in a power system). In Zimbabwe, they've only been able to count on eight hours of electricity each day since March 2019. In Nigeria, only 30% of the population can count on electricity. In the Democratic Republic of Congo, it's even worse," explains **George Ayittey**, a Ghanaian native and president of the Free Africa Foundation.

Marco Wirén, President, Wärtsilä Energy Business, says: "Although there are major differences between countries, with some having large electricity deficits and others being further along in meeting their citizens' energy needs, the continent as a whole is behind Europe and the US, and there's a huge need for electrification."

A COMPLEX PROBLEM

Africa's electricity struggles are all the more striking when you consider the fact that the African economy is growing steadily, albeit at rates lower than the World Bank previously projected. Data from the African Development Bank shows the continent's GDP growth reached 3.5% in 2018, up from 2.1% in 2016, and is projected to touch 4.1% in 2020.

Likewise, data from the EY Attractiveness Program Africa (2019) shows Foreign Direct Investment (FDI) in the continent, has remained largely steady, even if it has not returned to the highs seen in 2014. In 2018, 710 projects attracted USD 75.5 billion in capital and created 170,000 jobs, a five-year high.

So why, in spite of this, are large parts of Africa deprived of access to regular electricity? In short, supply hasn't kept pace with demand. This is due to a number of factors, including rapid urbanisation, failure to make necessary investments, and high costs for existing electricity supplies.

Pekka Tolonen, Europe Energy Business Director for Wärtsilä Energy Business, who has also worked on developing the company's projects in Africa, notes that the African continent has the world's fastest urbanisation rate. It is forecast that by 2040, more than half the population of Africa will be living in urban areas. Lagos doubled from eight to 16 million residents from 2009 to 2015. However, supporting infrastructure – including power grids – hasn't kept up. "Consequently, there are frequent blackouts, brownouts, and load shedding. Reliable power infrastructure is a major challenge today. This is partially because of a lack of generation, but also due to lack of transmission," he says.

"African governments have failed to make the necessary investments to expand electricity production," adds Ayittey, who says the current situation is dire. "Even South Africa's power utility company, Eskom, has failed to upgrade its generating capacity."

Wirén adds that lack of infrastructure and a dearth of funding also contribute to African utilities' challenges. "There needs to be the ability to build power plants and generation capacity. The African Development Bank, International Finance Corporation (IFC), and other institutions that can give grants and funding need to negotiate with governments to fund these projects," Wirén says.

The urgent need for capital means many African countries are also open to foreign investment in the energy sector. Ayittey points to the Zambian power utility, ZESCO, as an extreme example of this. In 2018, ZESCO's management and financial woes led to a full takeover by the Chinese Exim Bank, as confirmed in a January 2019 post by the bank.

National utilities' operating costs are also a challenge, as the bottom line is that their generation costs are higher than what they can legally charge consumers. As a result, they need to be continually subsidised, which is impractical if countries are working towards a healthy power market.

"When you don't have self-standing utilities, it becomes a

THE URGENT NEED FOR CAPITAL MEANS THAT MANY AFRICAN COUNTRIES ARE OPEN TO FOREIGN INVESTMENT IN THE ENERGY SECTOR.

very difficult situation," says Tolonen. He also explains why raising prices isn't a viable solution. "In the short term, if you want to sanitise the utilities, you would increase the power price – but that might kill the industries and wouldn't enable healthy economic growth. So, you're in a sort of lock-in situation."

Historical mismanagement of state-run energy companies by unqualified political appointees is also a problem. Ayittey argues that political change is necessary in these cases. "To be blunt, there are some countries that won't move forward without a new crop of leaders to undertake energy reforms under new leadership".

Finally, even those African consumers who are lucky enough to have access to a regular supply of electricity must contend with high prices. According to Tolonen, "A ballpark power price is two to three times more for energy in Africa versus Europe or America, while at the same time the population's purchasing power is much lower than in those comparable regions."

LEFT WITHOUT POWER

According to the World Bank's latest RISE (Regulatory Indicators for Sustainable Energy) report (2016), many countries in Sub-Saharan Africa lack officially approved electrification plans. Households and firms in these countries endure several hours of the day and night without access to power.

These energy shortages have ramifications across the board. Apart from reducing citizens' quality of life, they decrease the continent's attractiveness to businesses, preventing it from reaching its full potential. Ayittey offers the example of Nigeria to illustrate this point. "In Nigeria, the energy situation is so bad that foreign investors who want to establish a business have to provide their own electricity, water supply system, and possibly even their own road to take products to the market."

According to Tolonen, power instability is one of the factors contributing to high unemployment rates in many African countries. "You really can't create jobs in certain fields without reliable and stable power," Tolonen says.

THE RENEWABLE ENERGY OPTION

However, new technologies, especially renewables, offer hope. Many experts wonder why one of the sunniest spots on the planet is not leveraging the benefits of renewable energy to solve its energy problems.

In fact, hydropower by itself could serve the entire African continent's needs. According to Ayittey, the Congo Basin alone has enough hydroelectric potential to power the entire African continent. Ethiopia, for one, has already caught on to hydropower's potential, investing in a EUR 3,397 million dam project, the Grand Ethiopian Renaissance Dam Project, that will generate 15,000 GWh/year once completed.

Wirén is broadly optimistic about the African energy sector's future. He believes that it, like the telecoms sector, could leapfrog outmoded technologies and skip straight ahead to the latest developments.

"The African continent didn't build landlines; they went straight to mobile phones. Similarly, countries don't need to build up a huge fossil fuel capacity first and then go to renewables. Instead, they can use energy modelling to determine the most economically viable mix of generation," he explains.

Although Wirén believes many countries will still continue using fossil-fuel-based generation, he believes that growth in the sector will come from renewables, flexible solutions, and storage solutions coming online.

The Fekola mine in Mali is one example of this kind of hybrid solution. In December, Wärtsilä signed an agreement to provide an energy storage solution for the mine, allowing Fekola to add solar to its electricity production. Wärtsilä's advanced GEMS energy management software solution will optimise energy production for the entire mine through the use of the new storage system and a 30 MW solar plant currently under construction. GEMS technology uses artificial intelligence and automated decision-making based on real-time and forecasted data to maximise efficiency. Hybrid systems with energy storage are ideal for providing energy stability in operations for remote mining locations where the conditions are often challenging.

Tolonen believes that since investors the world over are generally backing away from more polluting power generation methods in favour of options that don't produce CO_2, their preferences might encourage the adoption of renewables.

Tolonen also says that renewables are also more promising from a purely cost perspective. In his opinion, their lower cost will crowd alternatives out, particularly in Africa, where fuel costs are high. "If you can sign PPAS (Power-Purchase Agreements) at two to three cents (the latest solar price record in Africa is 2.4 cents per kWh in Tunisia in September 2019, and we're seeing solar power plants signed in several countries just above 3 cents per kWh) across the African continent, that's a price that's a fraction of what we were seeing even two years back," Tolonen says. "The knee-jerk reaction is why would we build anything else if we can get this so cheaply? The first reaction is, 'I want to get more of this inexpensive thing.'"

reportage

"YOU CAN'T REALLY CREATE JOBS IN CERTAIN FIELDS WITHOUT RELIABLE AND STABLE POWER."

SENEGAL'S POWER STORY

Over 60%
of the Senegalese population has access to electricity. The rate is one of the highest in West Africa.

Around 40%
of the national energy production is supplied through Wärtsilä plants.

1 million
homes are still without power, but almost all urban inhabitants have access to electricity.

2.5 GW
is the generation capacity Senegal aims to achieve by 2030, with a greater predominance of natural gas and at least 30% renewables.

TEXT: PAYAL BHATTAR **ILLUSTRATION:** WÄRTSILÄ

THE DEAL OF A LIFETIME

In December, Anglo-Eastern agreed with Wärtsilä on a programme to digitalise its global fleet of more than 600 vessels in what was one of the maritime industry's largest digitalisation deals ever. What does this mean for the sector overall?

feature

"BETTER CONNECTIVITY IS A GAME CHANGER FOR US."

Hong Kong-based ship manager Anglo-Eastern and its technology partner Wärtsilä spent more than two years working on the right path for digitising the Anglo-Eastern fleet, but the programme the two firms developed is a game changer for the maritime industry. The solution supports full voyage planning and execution as well as engine performance and fuel-efficiency monitoring.

"It is a lighthouse deal. We deliver our solution to 600 vessels managed by AESM, but there are 60 ship-owning companies behind Anglo-Eastern as the ship management company. That makes it very important and valuable," says **Kay Dausendschoen**, Solutions Manager, Wärtsilä Marine Business. "It will have a multiplier effect. These owning companies are already asking us, 'I have half of my fleet with Anglo-Eastern, can I also apply Wärtsilä's solution to all my other vessels?' So, the deal with Anglo-Eastern is a door to a much larger pool of potential customers."

THE POWER OF CONNECTIVITY

This multi-year milestone agreement puts the focus on Wärtsilä's Fleet Operation Solution (FOS). FOS integrates individual processes that are otherwise separate from each other. It enables voyage planning, weather routing, ship-to-shore reporting, and fleet performance management to reduce fuel consumption, and takes into consideration charter party compliance and speed management, as well as the condition of the hull, propeller, and engine.

"We are keen to leverage the advantages of the latest digital solutions to maximise the efficiency of our voyages and the performance of our fleet. Realising the opportunities made possible by the Wärtsilä Fleet Operations Solution, we look forward to contributing to the further development of the solution as an early adopter," says Capt. **Bjorn Hojgaard**, Chief Executive Officer of Anglo-Eastern.

Wärtsilä's FOS is based on the connected Electronic Chart Display and Information System (ECDIS). This equipment is already mandatory on every ship, but the Wärtsilä FOS gives it a new and more significant importance. FOS is the common platform that integrates a connected ECDIS with a ship's planning station via cloud computing, machine learning, data analytics, and mobile applications.

"Fleet Operations Solution is exactly what we mean when we at Wärtsilä talk about utilising a Smart Marine approach to raise efficiencies, improve safety, and reduce the carbon footprint of shipping. We are excited to be bringing these benefits to the 600-vessel Anglo-Eastern fleet over the coming 12 months," says **Torsten Büssow**, Managing Director of Wärtsilä Voyage Solutions/Transas.

A recent trial of Wärtsilä FOS by Danish Shipping company J. Lauritzen A/S estimated that fuel worth USD 15,000 can be economised in just one voyage of one ship. Apart from fuel savings, there are several other touch points for savings, such as reduced friction between maritime stakeholders that help improve operations, reduce emissions, increase safety, and reduce crew workload.

For example, a ship owner and a charterer can close chartering deals with increased transparency, thereby reducing potential claims. FOS leads to better closure of commercial deals based on the ship's performance as well as a reduced risk of financial burden for the owner, since it provides early warnings of situations such as violations of charter party agreements.

"Better connectivity is a game changer for us," says Dausendschoen. "In the past, the connection bandwidth and overall connection between ship and shore was extremely limited. Connectivity for the merchant market was a very big problem because of bandwidth. Now that we have it, there are a lot of possibilities including data transfer between ship and shore."

OFF TO A FLYING START

The deal with Anglo-Eastern raises the bar for more transparency and efficiency in the maritime sector. It enables different stakeholders like ports, ship owners, and ships to plug in to one common platform to share or exchange data on a real-time basis. For example, it allows ports to connect with vessels via ship traffic control solutions to better manage arrival times. So, if all the berths in a port are occupied, FOS could share relevant information like the expected time of arrival with approaching vessels. That in turn enables ships to adjust their speed and operations, leading to fuel savings and lower emissions.

In some ways, FOS brings the shipping industry closer to achieving the same fleet management efficiencies as the aviation sector.

"If you look at aircraft, they have a slot system where the arriving airport already tells the departing airport when your arrival slot will be. It's kind of a similar approach. However, in the maritime industry it's a bit more complicated and very hard to implement because there is very little standardisation and sometimes conflicting interests among stakeholders," explains Dausendschoen.

He adds, "There are too many stakeholders and all very different from each other. Ports are different from each other, vessels are very different, etc. Low standardisation is one of the reasons why the maritime sector is lagging behind. Fortunately, we have technology as an enabler so it's possible to do it now."

Experts agree. As a 'new normal' characterised by increased market volatility, fluctuations in trade, and geopolitical and environmental risk emerges, ship owners and operators will have to rely on smart solutions like FOS to stay afloat. The deal between Anglo-Eastern and Wärtsilä is a giant leap in this new direction.

TEXT: LORELEI YANG **PHOTO:** 123RF

THE ELECTRIFYING CHALLENGE OF POWERING 10 BILLION PEOPLE

With the global population set to reach 10 billion by 2050, global political and economic systems must prepare for significant shifts. Next-generation renewable energies and radical changes to numerous sectors are needed to keep the planet plugged in.

"RENEWABLES TOGETHER WITH FLEXIBILITY ARE THE CHEAPEST WAY TO PRODUCE ELECTRICITY."

If your neighbourhood feels crowded now, consider this: the UN estimates that the global population will reach 9.7 billion by 2050 and around 11 billion by the end of the century. This population explosion presents some obvious challenges: Food, land and water resource are finite, so ensuring there's enough of these things to go around is critical.

Another concern: ensuring there's enough energy to power this global growth. In a 2017 article in the magazine *Anthropocene*, science journalist **W. Wayt Gibbs** hypothesised that everyone in the world will use energy at the same rate as the typical American by the end of the century – 9.5 kilowatts averaged over the course of a year. Based on this estimate, global energy demand will shoot up to 70 terawatts in 2100 (versus 18 terawatts consumed in 2016).

ELECTRICITY FIRST, AND THE REST WILL FOLLOW

In his 2008 book *Hot, Flat, and Crowded*, **Thomas Friedman** contended that global warming, globalisation, and population growth would converge to necessitate clean energy and green technology. This prediction has proven prescient, as clean energy adoption globally is ramping up to address climate change concerns.

Green hydrogen, wind lenses, and nature-distilled algae biofuels are only a few of the innovations in the pipeline. Governments, corporations, organisations, and individuals are all taking steps towards a sustainable energy future. For instance, Ikea – better known for cheap modular furniture than scientific innovation – is getting in on the renewable energy game with Solarville, a solar micro-grid enabling people to sell their excess energy to others on a blockchain-powered platform. **Marco Wirén**, President, Wärtsilä Energy Business, notes that the most transformative innovations to date have been in wind and solar energy, which have seen costs come down significantly, to the point of reaching grid parity in two-thirds of the world. This has already completely changed thinking around how to build affordable, sustainable, and reliable electricity grids. Managed properly, the shift to renewable and green energy in a broad range of industries should be attainable without significant additional costs passed on to customers.

To Wirén, the fast-evolving renewables and energy storage space holds both peril and opportunity. "On the one hand, the quickly evolving landscape makes it tough to make investment decisions over the long term. At the same time, the fact that renewables, together with flexibility, are the cheapest way to produce electricity creates immense opportunity for those ready to embrace the new way of thinking in the electricity market," Wirén says.

FUTURISTIC TECHNOLOGIES TO RISE TO THE CHALLENGE

When considering how to power 10 billion people without destroying the planet, one 'new' solution that has been around for over a century is to simply electrify everything. This broad, economy-wide electrification, which would entail using electricity to replace existing energy sources for space heating, water heating, and transportation, is expected to play a major role in decarbonising the future economy. Energy-intensive heavy machinery, such as heavy-duty trucks, buses, industrial boilers, and process heating, are prime targets for electrification.

However, experts warn that not all electric technologies are cost-effective, and some may have a long way to go to reach parity with incumbent technologies on a pure cost-comparison basis. The good news is that organisations around the world are actively working on solutions to bridge this gap.

Lauri Puro, General Manager in the Wärtsilä Energy Business Strategy group, sees the most transformative potential in Power-to-X technologies (P2X). He says: "As renewables become cheaper and cheaper and more of them are added to the grids, inevitably you'll have moments with excess renewable energy no matter what you do – first you'll store in batteries, but at a certain point, you'll even exceed battery capacity. At that point, energy essentially becomes 'free' raw material.

Cities like Tokyo are only going to get more crowded in the future. How will they cope with energy needs?

feature

For example, you can use the excess electrical energy and CO_2 straight out of the air to create fuel and use the fuel later."

If developed correctly, P2X holds significant potential for accelerating the rate of electrification across industries. "P2X creates an opportunity for the electricity industry to act as a catalyst for other industries to become sustainable, including the ones that are hard to electrify otherwise," Puro says.

A NEW GLOBAL ENERGY ORDER

Jim Carroll, one of the world's leading global futurists, says that there are a number of encouraging signs in the energy space. He says the rapid pace of technological innovation in the energy field, Silicon Valley's burgeoning interest in the world's energy challenges, and the dispersion of capital through crowdfunding platforms like Kickstarter are all converging to help ideas come to fruition much more quickly than before.

Carroll cites several cutting-edge technologies that are on the horizon, including growing solar cells from plants (currently being researched at MIT), solar-generating building glass, electrified roads, and the use of electric vehicles as daytime energy storage that sends energy back into the grid at night.

Another development is increasing interest from the energy industry in the idea of decentralised energy production ("microgrids"), in which energy is produced closer to consumption points, such as on the rooftops of homes. This idea has become more popular than the idea of "super-grids", which would connect large areas' energy grids to distribute supplies over larger areas.

As the world shifts to renewables and non-fossil-fuel energy sources, traditional oil powers may wane in geopolitical importance and be replaced by renewable energy leaders. Industrial powers like China, Germany, Japan, and the US could benefit almost immediately if they continue leading the way in wind and solar energy development.

Countries with growth potential for renewable energy generation could also see their status rise. Desert-rich countries with vast developable areas for solar and wind such as Morocco and Mongolia could eventually see an increase in their strategic importance.

While we can already foresee vast fields of windmills and photovoltaic panels powering the world's population in the future, even more exotic power generation methods may come into play sooner than we think, turning the stuff of science fiction into reality.

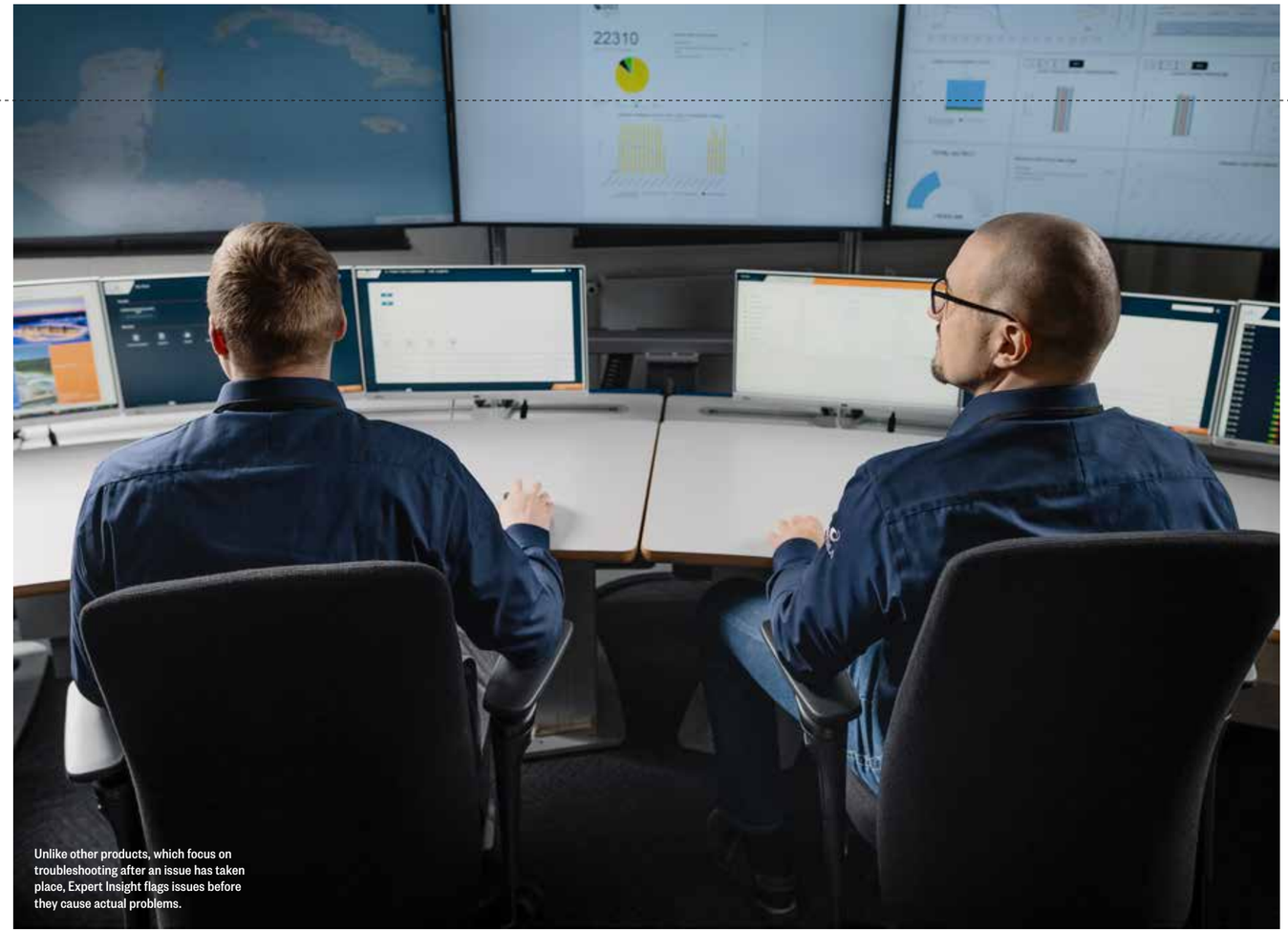
"P2X CREATES AN OPPORTUNITY FOR THE ELECTRICITY INDUSTRY TO ACT AS A CATALYST FOR OTHER INDUSTRIES TO BECOME SUSTAINABLE."

Microgrids are one solution being considered by smaller or more isolated communities looking to increase the use of renewable energy sources.

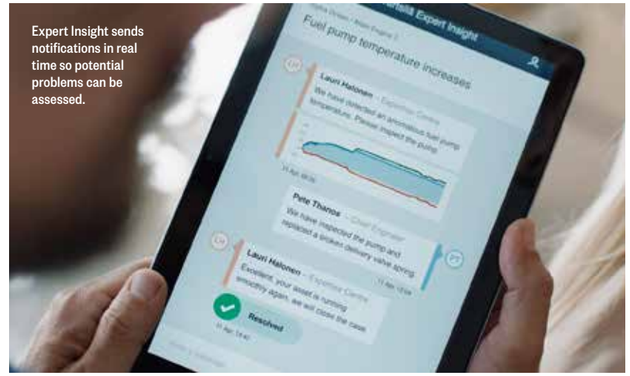
TEXT: LARA MCCOY **PHOTO:** WÄRTSILÄ

SEEING TOMORROW TODAY

What happens when you combine the knowledge of Wärtsilä experts and artificial intelligence? The outcome is a unique, cutting-edge predictive maintenance service.



Unlike other products, which focus on troubleshooting after an issue has taken place, Expert Insight flags issues before they cause actual problems.



Expert Insight sends notifications in real time so potential problems can be assessed.

The Expert Insight dashboard makes it easy to examine performance at a glance.

Wärtsilä is launching its new Expert Insight predictive maintenance service as a part of its Lifecycle Solutions portfolio. Expert Insight is a condition monitoring system powered by artificial intelligence (AI) specially designed to detect anomalies and potential equipment failures before they occur.

"It makes us far more predictive and proactive. We can now start to give advice to customers based on forward-looking predictions rather than looking backward at what's already happened," says **Paul Kohle**, Director, Performance Services, Wärtsilä Marine Business.

The system benefits from AI that learns as it accumulates data. Unlike other products, which focus on troubleshooting after an issue has taken place, Expert Insight flags issues before they cause actual problems.

"What is different today is that we tend to work by measuring the selected parameter with set alarm values, and only when these values are exceeded does an alarm register" says Kohle. "With Expert Insight, we predict the value itself. It can recognize a deviation at the earliest possible moment, long before we get to an alarm state."

The solution incorporates a neural network, a set of algorithms based loosely on the architecture of the human brain designed to recognise patterns in numerical data. It was built by Wärtsilä data scientists using Google TensorFlow, which powers the calculations behind the program and allows Expert Insight to crunch a year's worth of engine data in only a few minutes. Thanks to this speed, Expert Insight can identify anomalies in near-real time.

"Around 15 minutes after an anomaly happens, it will be flagged in Wärtsilä Expert Insight. This time frame will continue to narrow in the future as the hardware becomes more powerful and connectivity is faster," says **Frank Velthuis**, Wärtsilä's Director of Digital Product Development.

BUILT BY EXPERTS, CUSTOMERS AND SCIENCE

For more than two years, Wärtsilä engineers and data scientists worked on improving the AI to identify anomalies in data from the regular operations of engines, and to use both its successes and failures to improve itself. Despite the superior speed of AI in processing data, Expert Insight still requires humans to interpret the findings. When it flags an anomaly, experts at Wärtsilä Expertise Centres worldwide step in to take a look.

"Unfortunately, AI today doesn't yet have the capability to interpret the anomalies they discover. A computer can't determine whether an anomaly is a precursor of a severe failure or a less problematic defect, such as a broken sensor, which has no effect on machinery performance," explains Velthuis.

Nevertheless, by eliminating the need to pore over reams of data looking for problems, Expert Insight allows equipment experts to focus on supporting the customer proactively, preventing issues before they even occur, improving the overall performance of the systems in use.

EXPERT INSIGHT CAN IDENTIFY ANOMALIES IN NEAR-REAL TIME.

An important part of the process has been collaborating with customer experts, such as chief engineers or fleet managers, to identify and confirm underlying problems causing anomalies in data.

Because Expert Insight is developed wholly by Wärtsilä, it is easy to integrate into the company's product portfolio, says **Erik Ristiluoma**, Director, Marine Contract Management. Additionally, having the product in-house also avoids expensive licensing fees.

"We'll be able to bring this to our customers much more easily," Ristiluoma says.

Expert Insight also allows Wärtsilä to be more precise about the lifespan and maintenance requirements of its products.

"From a long-term service agreement perspective, the application can give us an opportunity to give better guarantees that equipment will function as it should and without interruptions, as we are better able to catch potential problems at an earlier stage," explains Ristiluoma.

ADDED VALUE FOR MARINE CUSTOMERS

In the marine sector, extending the lifecycle solution offering with Expert Insight means less downtime and fewer days in port. Expert Insight's real-time monitoring of shipboard performance allows for Remote Services to step in and determine if a port call is needed. Identifying potential anomalies in real time also means that ships can make the most of scheduled port calls and better predict maintenance costs.

"It's really about a reduction of unplanned downtime and maintenance, which are costly for marine customers," says Kohle.

PLANS FOR THE FUTURE

There are two paths being explored for expanding Expert Insight in the future. One path is to further deepen the AI's knowledge of four-stroke engine systems, incorporating even more data to increase understanding of the root causes of problems.

"There is a large potential population of engines that we can install the system to, and this will allow for gathering even more data to teach the system. The experts can then have even more time to dive deeper into helping customers solve problems," says **John Kop**, Wärtsilä Chief Digital Product Owner.

The other path is to expand the AI's capability to work with other equipment, such as 2-stroke engines, scrubbers, and gas systems on LNG carriers.

Both options open up numerous possibilities for Wärtsilä customers.

"Expert Insight gives us a very valuable building block for creating value, adding lifecycle solutions for our clients," says Kohle.

TEXT: HUNTER B. MARTIN **PHOTO:** 123RF

POSEIDON PRINCIPLES
USING FINANCE TO TAKE ON GLOBAL EMISSIONS

The global shipping industry is a major producer of greenhouses gases. Now a new initiative is asking shippers to confront the issue head-on.

The Poseidon Principles, which came into effect in June 2019, are the first global climate alignment agreement between financial institutions and the shipping industry. By connecting financing to emissions standards, their aim is to cut greenhouse gas (GHG) emissions in shipping by at least 50% by 2050 compared with 2008 levels.

"The international shipping industry produces 2-3% of global [greenhouse gas] emissions," says **James Mitchell**, Manager of the Global Climate Finance Programme at the Rocky Mountain Institute. To put that into perspective, that's about the same percentage of GHG produced annually by Germany. And as the number of ships on the seas increases, the rate of emissions is only going to rise.

"Emissions are expected to grow under 'business as usual' assumptions," Mitchell says. "There's a projection that shipping emissions, by 2050, will increase 50-250%. So, no one disagrees that we should be decarbonising."

BANKS AS 'PART OF THE SOLUTION'

According to **Paul Taylor**, global head of shipping and offshore at Société Générale Corporate and Investment Bank, banks have invested over USD 400 billion in over 70,000 commercial ships that are currently on the oceans.

"As a provider of capital, it is normal that banks understand the impact underlying collateral vessels have on the environment," says Taylor. "It's best to be part of the solution and embrace the unprecedented change that is currently taking place in the shipping sector as part of the energy transition. It is far better to help drive change than be a passenger whilst someone else drives at their own designated speed to an unknown destination."

Taylor is the vice chairman of the Poseidon Principles and currently plays an important role lobbying for them; the Rocky Mountain Institute was part of the core drafting group that wrote the Principles along with University College London, the Global Maritime Forum, three banks, shipowners, and a classification society.

The goal of the Poseidon Principles is to enable lenders and banks to continue to approach shipping competitively, while working collaboratively to promote responsible environmental behaviour. Banks, for their part, are working together to analyse potential future business models through the lens of climate risks to lending portfolios.

"As the first bank-led, sector-specific climate alignment initiative, the Poseidon Principles will help establish the huge role banks can play in helping a given sector meet climate alignment targets, consistent with wider bank commitments, such as the Paris Agreement and the Katowice Agreement," Taylor says.

At the June meeting in Helsinki of SEA20, a Wärtsilä-enabled initiative led by Smart and Ecologically Ambitious maritime cities to promote maritime sustainability, **Jules Kortenhorst**, chief executive of the Rocky Mountain Institute, said that maritime finance portfolios need to plan ahead to meet environmentally responsible regulations.

"You will no longer be able to get the financing to put new assets on the water that are not compliant with the Paris Agreement," Kortenhorst said.

John Hatley, Americas Vice President of Wärtsilä Marine Business and Director of Market Shaping, says that the principles are a shift in the approach to promoting sustainability.

"The Poseidon Principles represent a major global step change towards moving the entire marine community environmental stewardship as it's 'money that fuels deals' across commercial investments," Hatley says.

ASIA NEEDS TO SIGN ON

Currently there are 11 Poseidon Principles signatories from American and European financial institutions. However, Chinese banks control about 25% of all ship finance, according to the Wall Street Journal.

"We expect Asian banks, including Chinese lenders, to be in the next wave of signatories to reflect Asia's preeminent position in shipping," Taylor says. "I am confident that Chinese lenders and export credit agencies will support the Poseidon Principles in the coming months, as will financiers from Japan, Korea, and Singapore."

Mitchell agrees that Asian lenders have to sign on for the initiative to work.

"This agreement is not static; it's going to continue to grow," Mitchell says. "Fundamentally, for this agreement to work it needs to be global, and it's not going to be global without the Chinese financial institutions on board."

MAKING MORE MONEY AVAILABLE

Both Mitchell and Taylor say that the shipping industry has to learn to plan five, 10 or even 15 years in advance. This can be difficult considering that many shipping contracts only last six months to a year.

"THE POSEIDON PRINCIPLES SHOULD ENSURE THAT THERE IS GREATER LIQUIDITY AVAILABLE FOR NEW INVESTMENTS."

"It falls to the lenders to work with and partner with their clients to figure out how you are going to put in place a plan to meet that objective," says Mitchell. "It's no longer an option to not have a plan. The entire world is going in this direction. There are serious financial risks for not going in this direction. So, let's work together and figure out how we can actually achieve this aim."

Taylor says that making more money available is one way to move forward.

"The Poseidon Principles should ensure that there is greater liquidity available for new investments, including new fuels and technologies," Taylor says. "This will require banks to take more risk in the short term, alongside shipowners. In time, as newer technologies prove themselves as the new standard technology, shipowners and banks will naturally de-risk, whilst aligning themselves with IMO targets."

The Poseidon Principles have the potential to impact the global shipping sector for decades and significantly lower GHG emissions by involving all parts of the shipping industry, not just the ships themselves, according to Hatley.

"[The Poseidon Principles] will impact all supporting ecosystem elements including stakeholders and actions; vessel owners, ports, energy supply, capital equipment, ship designs, shipyards, and cargo logistics; as well as regulatory institutions," Hatley says.

While the principles aren't a panacea, they represent a significant step forward – and not just for shipping.

"This agreement will not decarbonise the shipping sector alone. We need stronger policy to achieve that, but it will play a tremendous role in forcing companies to think longer term and make robust plans," says Mitchell. "This is the cutting-edge agreement in the field of climate change. This agreement is by industry, for industry, and we think it's a model that should be replicated [in other sectors of business]."

TEXT: KIRA EGOROVA **PHOTO:** 123RF

HOW ADVANCED MODELLING IS HELPING UKRAINE GO GREEN

Ukraine is experiencing a boom in renewable energy generation, the result of a decade of multiple government attempts to stimulate the sector. But integrating the post-Soviet power system that makes up the base of the sector with wind and solar has not been easy.

in-depth

Ukraine provides an interesting case study into the challenges of integrating green technology into non-flexible energy systems. Changing the country's existing infrastructure , both physical and regulatory, requires politicians, officials, and businesses to sign on to a programme whose benefits are difficult to see. But power system modelling based on big data analysis can help bring clarity and create a clear path to a carbon-neutral future.

FOR THE SAKE OF THE MARKET LAWS

In 2017, Ukraine's government adopted Energy Strategy 2035, setting the ambitious challenge of adapting the country's existing power system to integrate it with the European one. In practice, this means the physical integration of the Ukrainian power network to ENTSO–E, the power network of the European Union (EU).

"These changes would not only give the country the ability to begin trading energy with the EU – they would also promote energy efficiency and security," says **Igor Petryk**, Senior Market Development Manager at Wärtsilä Energy Business.

In order to stimulate the renewable energy production required under Energy Strategy 2035, the Ukrainian government set special fixed green tariffs of EUR 100–150 per 1 kWh – more than twice the tariffs for power produced from nuclear and coal sources, which fluctuates with the market but costs around EUR 60 per 1 kWh. To guarantee demand for the more expensive renewable energy, the Ukrainian government created a "guaranteed customer" system and required the purchase of energy from renewable sources.

As a result, over the past couple of years, these tariffs boosted production of green energy. Plenty of solar panels and wind generators have been placed on Ukraine's fields and valleys. According to Petryk, the capacity of wind and sun energy generators will reach 7.5 GW by the end of this year. For comparison, average energy consumption in Ukraine is around 18 GW, ranging between a peak of 26 GW in winter and 12 GW in summer.

But these same conditions that boost renewable energy production also add to its cost.

"As the price of solar panels and wind turbines has gone down over the past years and installations became viable without subsidies, many countries switched from feed-in tariffs to auctions, which reduces the electricity price for consumers," says Petryk.

"Ukraine failed to introduce the auction system on time. As a result, the super-generous tariffs have attracted massive investments into the generating capacity that enjoys guaranteed payments," Petryk says. "The cost of renewable energy is now becoming disproportionally high, and this may create an unbearable burden for consumers and a threat for further development of clean energy."

An additional problem, according to Petryk, is the inflexibility of the power system dating back to the Soviet era. "We at Wärtsilä believe this system is probably the most inflexible power system in the world. It is simply unable to absorb the rapidly growing volumes of intermittent green energy."

As a result, the transmission system operator will have to curtail about 30% of renewable power generation, which under current law would still need to be paid for. As a result, the Ukrainian economy risks losing up to EUR 580 million producing green energy that can't be consumed or stored.

NOT JUST UKRAINE

Ukraine isn't the only country facing the challenge of integrating renewables into its energy mix. The main difficulty comes from the fact that renewable energy generation depends on sources – wind and sun – that are not regular and sometimes not even predictable. Making the most of these sources requires a power system to be very flexible: there should be sources of extra energy in case renewable ones are temporarily unavailable. Ukraine, however has a particular problem based in its Soviet-era energy infrastructure. The main sources of power are nuclear power plants, which are difficult to bring on- and off-line, and coal-fired power plants, which contribute substantial CO_2 emissions to the atmosphere.

POST-SOVIET PROBLEMS TO POWER MODELLING

For more than two years, experts from Wärtsilä have been modelling Ukraine's power system in cooperation with the state transmission system operator (TSO) to look for alternative options for flexible power generation.

The kind of complex calculations needed to do the modelling were made by PLEXOS, an advanced data analytics program. PLEXOS software, which was developed for the purpose of optimising power systems, allows transmission system operators, utilities, and consultants to build a model of the power system and analyse various strategies for adding capacity or dispatching the assets, according to **Jan Andersson**, Senior Market Development Analyst at Wärtsilä Energy Business.

"The model takes into account important parameters such as renewable generation, power system reserves, costs, and emissions as well as

POWER SYSTEM MODELLING BASED ON BIG DATA ANALYSIS CAN HELP BRING CLARITY AND CREATE A CLEAR PATH TO A CARBON-NEUTRAL FUTURE.

Integrating Ukraine's coal and nuclear-powered energy grid with modern renewable technology has been challenging.

in-depth

"BY ADDING 2–3GW OF FLEXIBILITY IN THE SYSTEM, RENEWABLE ENERGY CAN BE FULLY UTILISED."

Smoke from coal-fired power plants covers the city of Mariupol in eastern Ukraine.

power-plant-specific parameters such as start cost, ramp rates, and minimum up and down times," Andersson explains.

All of these parameters are necessary to build the most realistic model of the power system possible, thereby generating accurate and reliable results.

In the Ukraine case, Wärtsilä calculated 20 different scenarios, combining the power generation capacities of renewable sources and internal combustion engines. The researchers came to the conclusion that the country needs an extra 2GW of flexible energy, which can be generated by internal combustion engines running on natural gas.

"By implementing these engines rather than relying on coal-powered power generation, the country can save approximately EUR 300 million," Petryk says.

The internal combustion engines also produce fewer CO_2 emissions compared to coal-fired power generation. In fact, according to Wärtsilä's calculations, using the internal combustion engines will shrink the CO_2 emissions of power generation in Ukraine by 15%.

"Our results show that by adding 2–3GW of flexibility in the system, renewable energy can be fully utilised, and CO_2 emission can be reduced significantly and at a lower cost compared to the business-as-usual case," says Andersson.

Andersson says that Ukraine's power system presents an interesting challenge. The current system, largely based on nuclear and coal power generation, is not suited to flexibility. Nevertheless, flexibility is exactly what is needed to utilise as much as possible of the increasing amounts of renewable energy promoted by government programmes. Looking ahead, Andersson says, it would be sensible for Ukraine to keep its nuclear power systems as long as possible as this energy source is already CO_2-free. Coal should be reduced in favour of renewables, and flexible thermal plants running on gas would support integration of renewables in the power system. In the future, these flexible thermal plants can be converted to bio or synthetic gas to become carbon neutral.

A QUICK GLANCE AT WÄRTSILÄ'S POWER SYSTEM MODELLING

- It aims to understand the operation and fundamentals of power systems and find an optimal capacity mix with optimised system total cost.
- It creates a model for power plants, transmission systems, power reserves, and the local energy market and then studies various scenarios to determine the optimal way forward for the specific country or region.
- The model has been used in more than 60 power systems worldwide – Ukraine, South Africa, and Italy, to name a few.

TEXT: SARAH HUDSON **PHOTO:** 123RF

AI AND A 100% RENEWABLE ENERGY FUTURE

Wärtsilä's machine-learning software and advances in energy storage are changing the landscape of solar and wind power. Together, they form the building blocks of a 100% renewable future.

When it comes to getting smart about renewable energy, exotic locales like the Azores archipelago and the Caribbean make excellent testing grounds thanks to their high fuel costs and abundant wind and solar resources. On the islands of Graciosa and Bonaire, machine learning is hard at work, harnessing wind and solar energy output and optimising the power grid.

Using AI to combine renewable sources with a new generation of energy storage systems such as E.On's Texas Waves, these projects represent the intertwined sides of the smart energy equation: optimisation and storage. They're at the forefront of a smart energy reovlution based on cheap, reliable and 100% renewable sources.

SUN, SEA, SOFTWARE

When a smart energy project was first conceived for Graciosa in 2006, the island had been relying on a diesel-generated power plant for decades. The aim was to achieve 65% renewable energy for the entire population with 100% renewable power capability depending on real-time renewable availability. According to General Manager, Data Science **Luke Witmer**, things are on track.

While the most visible step might be the construction of functional wind farms and solar collection, behind the scenes, it is energy management software that's making renewable energy security a present reality.

"Wind and solar are potentially excellent renewable energy sources, but they're also volatile and unpredictable," explains Witmer. "You have to have ways of keeping the electrical grid sound if you're to let those energies into it."

Endlessly switching between collecting, storing and doling out power as the needs of the grid fluctuate, the energy input rises and falls, and as battery capacity drains or maxes out is a delicate dance. It relies on hard logic, forecasting, and statistics. With the right human guidance, machines excel at this optimisation.

DOES AI PLAY A PART?

Witmer explains that while there's been some hype about the potential role of artificial intelligence in managing the volatility of wind and solar, the technology is not quite there yet.

"Computers are trained by humans, with large swathes of data that's been cleaned, processed, and filtered. Humans are still heavily involved in making sure we feed good info to the computers," he says.

While in the future AI will have an important role to play in operational planning, true "self-learning" isn't yet a feature of energy generation, says Witmer.

However, in the case of Graciosa, which has a battery big enough to power the whole island for nearly an hour, machine learning makes reliable wind and solar energy possible for everyone's needs. On Dutch-owned Bonaire, which has a notably larger population, it's a matter of scaling up the optimisation and statistical forecasting.

Meanwhile, E.On's Texas Waves facility is working on the storage side of the equation. These energy storage systems not only store an increasing amount of energy from wind and solar, but they also monitor the electrical quality of grid conditions, very quickly responding and balancing supply and demand shortages with bursts of power in both directions.

As complex systems are augmented with AI, it has become clear that machines are now able to carry a level of intelligence and capability to autonomously operate in ways that humans alone could not do. That said, it is more about the augmentation of the human operator condition than the replacement of the operator.

"NON-RENEWABLE ENERGY HAS BEEN STABLE AND DEPENDABLE... BUT WE HAVE TO ADMIT THAT IN THE NEW WORLD OF RENEWABLES, IT ALMOST FEELS LIKE A DINOSAUR."

DISRUPTING THE INDUSTRY

Machines aren't the only ones getting an education, though. **Risto Paldanius**, Director of Business Development at Wärtsilä Energy Business, highlights the disruption wind and solar power represent for a slow-moving industry.

"Non-renewable energy has been stable and dependable. It has existed for good reason," says Paldanius. "But we have to admit that in the new world of renewables it almost feels like a dinosaur."

The industry needs to get used to the idea of being more agile, he says. A nuclear power or gas plant used to stay viable for up to 50 or 60 years, yet today there are plants that can be built in six months, operated for a decade and then replaced with newer technology. It's a game changer for investors, but this smart investment will have huge payoffs for those who get it right – not to mention for the planet.

NO LOOKING BACK

Towards the end of the commissioning and the beginning of the endurance testing, Witmer's team realised that they were a button click away from delivering 100% renewable energy to Graciosa's entire population for the first time.

"We thought: 'Ok, no looking back,'" recalls Witmer. They clicked the button.

For the first time in decades, the diesel power plant fell silent. The wind blew… and the lights stayed on. It was one of the highlights of a job that regularly takes Witmer through the full gamut of emotions.

"I love what I do. It has spiritual meaning – for humanity as well as the rest of the planet and everything in it. The technology is here. If there's one thing we should be able to figure out, it is this."

TEXT: LARA MCCOY **PHOTO:** EMMI KORHONEN

Innovating people

Alid Dettke, who stepped into the role of Executive Vice President of Human Resources at Wärtsilä in October last year, is drawing on her experience in digital transformation to revitalise the company's internal processes.

passion

"I'D LOVE TO ARRIVE AT A PLACE WHERE WE IN HR ARE TRUE PARTNERS TO THE BUSINESS FROM A HUMAN PERSPECTIVE."

An only child in a tight-knit family, **Alid Dettke** spent her childhood in northwestern Germany focused on school and sports, particularly with her rowing team. As she got older, Dettke's parents encouraged her to learn English, travel, and try new things, but like most teenagers, she didn't tend to listen too much to their advice. Then, on a trip to Berlin to visit relatives, she met someone who made her look at life in a different way.

"I was quite content, and then something happened that was a life-changing moment for me," Dettke says. "I went to Berlin a few years after the Wall came down, and I met a lady who had grown up in East Germany where there were hardly any opportunities to see the world. Talking to her was a key moment in my life, because it is when I realised that I actually wanted to be more open and curious about what was going on in the world around me, while not losing touch with my roots."

ALWAYS READY FOR A CHALLENGE

Dettke has carried that openness with her throughout her career, and it's served her well. After graduating with a degree in European business, she decided that rather than stay in Europe, she would instead take a job in Singapore. She spent more than a decade in Asia, moving through various positions, including in consumer research, analytics, digital strategy, and transformation. She says she learned a lot on the job.

"I've realised that you can't possibly always be fully ready for what is in front of you, so it's important to seize the moment, take the opportunity when it is there, and work with the people around you to grow with the challenge," she says.

It's a philosophy she's now bringing to Wärtsilä's HR department.

Dettke does not have a formal HR background, but she says that she has a strong team of professionals to lean on. And she says that her experience in open innovation is particularly relevant for the field of HR at this moment.

"There's no shortage of great HR professionals at Wärtsilä, and now is a great moment to add to this the synergies of how we innovate to take HR to the next level and increase our focus on people and culture," Dettke says.

"I've asked people what they would like to stop and what they'd like to see more of, and the responses were very clear: Less focus on processes, admin, and what seems like 'ticking-the-box' exercises and more focus on what really matters – people and culture, the way we work, how we collaborate, how we grow and reward our people. I truly believe that this is how we bring Wärtsilä on the path of long-term success in our industries, serve our customers and fulfil our purpose in the long term."

Dettke thinks her background in digital transformation can help change the way people look at HR. "I'd love to arrive at a different place where we in HR are true partners to the business from a human perspective," she says. "I think we have so much potential to do things more efficiently, when you need it, and to use a smart tech mindset to get things done."

DEFINING A ROLE

Before being appointed to lead HR, Dettke spent two years at Wärtsilä as Head of Open Innovation. She says that making the decision to initially join Wärtsilä was easy, because although she had not heard of the company before, the position within open innovation was brand new and gave her the opportunity to create everything from scratch and build the team, which was hugely exciting and rewarding.

"When I took the position in open innovation, the role was totally undefined, it was like a blank sheet of paper, and I thought, I have to take this opportunity because these kinds of chances don't come along every day," she says.

Her experience is especially useful for Wärtsilä right now.

"The world around us keeps changing. Today's business environment is rather volatile, and the ability to precisely predict the future is becoming more and more challenging," she says. "This creates uncertainty, and people are wondering how to stay relevant. They wonder what role they have to play in this company at this moment. We in HR are here to support our people on this journey."

She wants people experiencing this challenging global business environment to understand that while the present is full of uncertainty, it's important to focus on long-term goals. This

Alid Dettke says that in today's volatile business environment, it's important to focus on the long-term.

understanding builds resilience and also helps employees think more about purpose and strategy.

A MARATHON, NOT A SPRINT

"We aren't sprinting from quarter to quarter; we're in it for the long run. It's a marathon, and we need to train ourselves to be fit," she says.

For Dettke, that means asking what HR can do to make people capable and resilient in the longer term. She's approaching that question with the same perspective she brought to the role of open innovation – the blank sheet.

"After all these changes, we've now come to a point where many of the things we've done in the past are no longer working – not working from a business perspective and not working for our people either, so we have a golden opportunity now to fundamentally think about how we want to be working together," she says.

Her current efforts aim to bring more alignment between corporate and personal goals. She believes being more transparent about both challenges and opportunities at the corporate level will help give employees more autonomy and help them both take control of their own futures while visualising a space within the company.

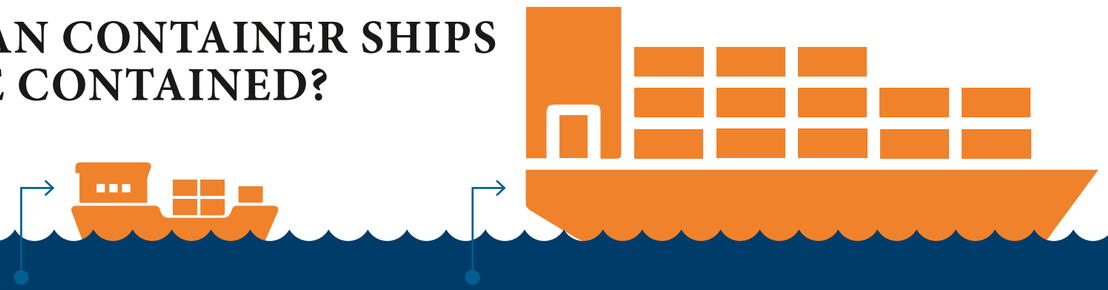
"It's all about empowering people and rewarding them accordingly," Dettke says. "We're turning the page and writing a new chapter for how we move into the future."

"WE HAVE A GOLDEN OPPORTUNITY TO FUNDAMENTALLY THINK ABOUT HOW WE WANT TO BE WORKING TOGETHER."

Alid Dettke believes that more transparency about both challenges and opportunities will help employees take control of their own futures.

TEXT: CRAIG HOUSTON

CAN CONTAINER SHIPS BE CONTAINED?



CONTAINER SHIPS HAVE INCREASED THEIR CAPACITY MASSIVELY OVER THE PAST 50 YEARS, WITH MORE BEING BUILT.

In 1968, the largest container ship had a capacity of **1,530 TEU***

This year, a ship with **23,000 TEU** capacity was launched

* TEU = Twenty-foot Equivalent Unit
1 TEU = 6m long × 2.4m wide

That's an increase of over **1500%** increase in just 50 years

Currently, ships with a capacity of **24,000–25,000 TEU** are in production

What's to stop them from getting bigger?

Vessels over **50 metres** in width can only have a **12-metre** draft

Risk of single route investment will deter reliance on super containerships

Maintenance costs can be higher, negatively affecting operating costs

The width of the **Suez and Panama Canals** can accommodate only certain sizes

Harbours and terminal operators prefer smaller ships to **avoid congestion**

Why could a return to smaller vessels be the answer?

More route flexibility

Higher vessel utilisation

Excess TEU capacity in the market

Lower maintenance costs

Reduced reliance on transshipment

More flexibility for ports

What will the game changers be?

Connected fleet and port operations will lead to higher efficiencies

Future energy solutions will lead to **zero emissions**

Improved **cooperation and integration** between vessel and land-based logistics

TEXT: DAVID J. CORD **PHOTO:** WÄRTSILÄ & ANDREAS JUNELL

WÄRTSILÄ 31SG PROVIDING POWER THROUGH RAIN OR SHINE

Its efficiency and reliability make the Wärtsilä 31SG the engine of choice for utilities that are transitioning to renewables. The case of Cooperative Energy in Mississippi is one such example, allowing for flexible generation to support solar power, as well as resiliency in case of hurricanes.

The US state of Mississippi has memorable weather. Summer is defined by hot sunshine. Hurricane season is defined by – no suprise – hurricanes. This weather plays a vital role in Mississippi's energy system and was on top of the agenda when local provider Cooperative Energy began to talk to Wärtsilä about upgrading their Benndale plant.

Cooperative Energy is a not-for-profit, member-owned electric cooperative covering 432,000 homes and businesses in Mississippi. In 2005 coal produced more than half of their energy, but today cleaner natural gas makes up about two-thirds of the mix. Cooperative Energy also has six solar sites, showing the increasing importance of Mississippi's sunshine in providing power.

NOT JUST ABOUT THE PRODUCT, BUT THE PEOPLE

"There is a lot of variable generation in our market, such as our 52 MW solar plant," says **Jim Compton**, President Emeritus of Cooperative Energy. "We need to match variable generation with more flexible capacity which can rapidly start up when needed. Wärtsilä's generation units meet this need. The 31SG engines are top-of-the-line."

Cooperative Energy chose the Wärtsilä 31SG engine to upgrade the Benndale plant. The gas-driven engine can provide simple-cycle efficiency levels in excess of 50%, compared to about 40% with modern gas turbines. It is also able to respond rapidly to continuously changing load patterns found in systems with intermittent solar and wind energy.

"I wanted to be satisfied with the technology and the people behind it, so we visited Wärtsilä's factory and testing facilities and met the engineers," Compton says. "This is not just about a product, but the people. I needed to be comfortable with everyone involved in design, installation, and maintenance. I was very impressed."

EFFICIENCY AND FLEXIBILITY ARE ESSENTIAL

Wärtsilä is delivering a 22.7 MW engine power plant under a full engineering, procurement, and construction (EPC) contract to Cooperative Energy.

The two Wärtsilä 31SG engines at the Benndale plant will be used as peaking units with frequent cycling. Their ability to act as fast, flexible, and reliable support for renewables was an important contributor to their choice for the plant.

"The 31SG engine is highly efficient, has higher availability, produces fewer emissions, and has longer maintenance intervals," says **Toni Haarala**, Senior Project Manager at Wärtsilä. "It can start and stop several times a day which is essential to support renewable energy. It provides flexibility for the future expansion of renewables for Cooperative Energy."

The world is moving towards a 100% renewable energy future, yet it is a known fact that renewables are highly weather dependent. The solution to solve this challenge can be advanced energy storage solutions and engine power plants. If clouds obscure the sun and the production of solar energy drops, we need to have flexible and fast-starting engines such as the Wärtsilä 31SG to fill the need.

"With the modular design the customer has the ability for easy expansion for future requirements," Haarala explains. "If they need more power in the future, we could easily put in two more units without any major effort by extending engine hall, and adding engines and auxiliaries, almost like plug and play."

"Wärtsilä's philosophy is to support customers' journey to a 100% renewable energy future by delivering flexibility and reliability with an efficient solution. This enables the customers to lower energy costs. Another cornerstone in this philosophy is being with the customer throughout the lifecycle of the installation to make the most of it", says **Dan Shelledy**, Senior Business Development Manager in Wärtsilä Energy Business.

After the project has been fully handed over to Cooperative Energy by Wärtsilä, the partnership between the two organisations will continue via a 10-year service agreement covering maintenance of the Wärtsilä 31SG engines and related auxiliary components. This lifecycle solution includes all scheduled maintenance activities, spare parts, condition-based monitoring, and response time guarantees should an unscheduled event arise. "By having lifecycle support and services from Wärtsilä, Cooperative Energy can focus on their core business with the knowledge that the Benndale plant will be available to operate when needed and that all covered equipment has been maintained to ensure the power plant performance," Shelledy concludes.

KEEPING A CLEAN AND SAFE WORKSITE

Yet Wärtsilä did not simply sell Cooperative Energy two new engines with maintenance for the next 10 years.

Local electricity provider Cooperative Energy chose the Wärtsilä 31SG engine to upgrade its Benndale plant.

"WE NOT ONLY LOOKED FOR RELIABILITY, QUICK START, EFFICIENCY AND GOOD OPERATIONAL FLEXIBILITY, BUT WE ALSO NEEDED BLACK START CAPABILITY."

Wärtsilä engaged in a full EPC agreement to oversee the entire project

"Wärtsilä's EPC contract has gone very well," says **Trey Cannon**, Director of Generation Projects at Cooperative Energy. "They started on site in February 2019 and were delayed by heavy spring rains, but they've overcome that challenge and made up some time. We're still well ahead of the guaranteed delivery date and I appreciate the way Wärtsilä set such an ambitious schedule."

Cannon says that he is pleased that the private landowner next to the site has had no complaints about the work being done next door.

"It's a clean and safe site," Cannon says. "We've had about four first-aid incidents, one of which was a wasp sting while another was a strained muscle. That really is a pristine safety record if you think of a job with 100,000 man-hours."

RESILIENCY IN EXTREME WEATHER

The Benndale plant can help support and complement the energy produced by Mississippi sunshine, but it also has to deal with less pleasant weather: hurricanes.

"Reliability and resiliency are extremely important for our system, particularly when it comes to responding to hurricanes," says **Nathan Brown**, Chief Operating Officer of Cooperative Energy. "The Benndale plant is in the southern part of our system and twice it had to restore critical loads in the area, after Hurricane Frederic in 1979 and after Hurricane Katrina in 2005. After Katrina, Benndale provided services to hospitals and other critical loads in the area for several days before energy was restored."

This leads to another benefit of the project: the ability to 'black start', or start with no power to the grid. The Benndale plant can carry out initial energisation of sections of the network so it can provide power to critical local infrastructure like hospitals and communications.

"We not only looked for reliability, quick start, efficiency and good operational flexibility, but we also needed black start capability," Brown says. "Wärtsilä meets all our needs, which is important both for us and our community."

Twentyfour7.
in detail

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WÄRTSILÄ GIVES A BOOST TO WORLD'S LARGEST SEMI-SUBMERSIBLE CRANE VEHICLE

▶ **TEXT:** LORELEI YANG **PHOTO:** WÄRTSILÄ

CREATING STATE-OF-THE-ART FEATURES for Sleipnir, which will remove and install structures in the open sea, required extensive knowledge, creative thinking, and open communication.

Each of the Wärtsilä thrusters for Sleipnir is rated for 5.5 MW power.

Last summer, Wärtsilä delivered the biggest steerable thruster in its new thruster portfolio for *Sleipnir*, the world's largest semi-submersible crane vessel (SSCV). As a feat of engineering, *Sleipnir* is impressive on multiple levels. The environmentally friendly LNG-powered vehicle features two revolving cranes that can lift up to 20,000 tonnes in tandem – that's the twice the weight of the Eiffel Tower.

The delivery was the culmination of a five-year effort that began with conversations between Wärtsilä and *Sleipnir*'s owner, Dutch offshore contractor Heerema, in 2014.

Before the project began, Heerema studied market requirements and evaluated several vessel concepts, and concluded that it wanted a semi-submersible type hull for its new vessel. Based on past projects, Heerema knew that Wärtsilä would be a reliable partner for developing innovative new solutions to meet these requirements.

Lauri Tiainen, Director, Thrusters, Wärtsilä Marine Business, notes that close collaboration between Wärtsilä and Heerema throughout *Sleipnir*'s development was integral to the project's success.

"Having a direct customer [Heerema] involved in the development helped better align the development with the customer's desires. So, we came together and said, let's commit to doing this together," Tiainen says. This cooperative process allowed Wärtsilä and Heerema to develop the never-before-seen technologies that made *Sleipnir* possible.

FIRST-OF-ITS-KIND TECHNOLOGY

Through joint discussions, Wärtsilä and Heerema developed 360-degree rotatable, retractable thrusters with underwater mountability for *Sleipnir*. The project is the first time both retractability and underwater mountability features have been brought together in a single thruster design.

The underwater mountability was especially important.

"Because *Sleipnir* is so big, there are only a handful of dry docks in the world that a vessel this big can enter," says Tiainen. "Thus, from a risk mitigation perspective for the customer, not having to go into dry dock for assistance is valuable."

In addition to their unique design, *Sleipnir*'s thrusters are also mounted at an eight-degree downward angle. Tiainen explains the rationale: "From Wärtsilä's research in hydrodynamics, we've found that this angle ensures water isn't pushing against the ship's hull. It doesn't make sense to burn a lot of energy to produce water flow if it's hitting your own vessel. This configuration, which minimises that problem, is much more efficient and effective both for moving the ship forward and keeping it stationary. With these thrusters, the ship can travel the globe fairly quickly with its own thrusters, which allows it to cover the broad geographic area that's needed to fulfil jobs. With the thrusters, the ship can also be maintained very precisely in position during lifting jobs."

To account for the large amounts of ballast that *Sleipnir* takes in and the depths to which the vessel may sink (up to 32-40 metres into the baseline for the ship itself, and even deeper for the thrusters), significant R&D was needed to ensure the thrusters would remain water-free even at deep depths. *Sleipnir*'s thrusters are sealed with Wärtsilä Ocean Guard anti-pollution face-type seals. They are constantly monitored for possible leakages to ensure lubrication oil from the thrusters doesn't enter the sea and drained for oil recycling. Similarly, seawater leakages can be drained in a controlled manner to avoid water intrusion into the thruster unit.

> THE PROJECT IS THE FIRST TIME BOTH RETRACTABILITY AND UNDERWATER MOUNTABILITY FEATURES HAVE BEEN BROUGHT TOGETHER.

PRECISION IN CHALLENGING CONDITIONS

As the world's largest crane vessel, *Sleipnir* is used for heavy lifting jobs, largely in the open sea. On 8 September 2019, it completed the world's largest-ever lift (15,300 tonnes), installing the topsides for Noble Energy's Leviathan development in the Mediterranean. In total, *Sleipnir* installed the development's two main topsides with a total weight of 24,500 tonnes in less than 20 hours.

"In the jobs it performs, *Sleipnir* must lift huge loads very precisely to install wind turbines or install big offshore platforms while fighting against constant wind and waves," observes Tiainen. "So, the thruster system and positioning system need to work together in precise cooperation to maintain the position and avoid safety risks regarding the load that's being lifted."

With these challenging conditions in mind, *Sleipnir* was built to have the highest possible degree of system redundancy at all levels as well as dynamic positioning (DP3).

"Whatever failure happens, you won't lose your position," Tiainen says. "There's a lot of extra engine capacity, and even if you lose two of the thrusters, you're still able to stay in the same position, despite the wind and waves."

The features ensure that *Sleipnir* is maximally safe and mitigates as much risk as possible.

Finally, *Sleipnir* has an extensive condition-monitoring system that optimises inspection and monitoring procedures towards predictive maintenance and helps avoid nasty surprises as the thrusters experience normal wear and tear. This increases predictability and reduces the risk of unexpected downtime, which according to Tiainen is important because *Sleipnir* is the only vessel of its type in the world. If it's out of commission, there are certain jobs no other vessel could perform in its place.

Even though the thrusters are completed, Wärtsilä's work on *Sleipnir* is far from done, as the two companies will be working together to maintain the vessel for at least the next 30 years.

SMART MARINE JUST GOT A LITTLE SMARTER

▶ **TEXT:** NICHOLAS MARTIN **ILLUSTRATION:** WÄRTSILÄ

WITH RICHER DATA and faster connectivity, the upgraded Operim system lays the groundwork for new business models as part of Wärtsilä's Smart Marine Ecosystem. With its unique packaging of hardware and subscription-based software, the new Operim demonstrates the company's commitment to upending traditional ways of doing business.

With the newly upgraded version of Operim, released at the Nor-Shipping trade fair in Oslo in June 2019, Wärtsilä shows that it is serious about anchoring itself in the domain of intelligent engineering.

The Operim system was first launched in 2011 to monitor the performance of Wärtsilä's LNG cargo and reliquefaction plants on ships. Operim, short for Operational Performance Improvement & Monitoring, lives up to its tagline: "Forget about optimisation – with Operim, it's always on."

Originally designed to monitor and optimise onboard gas plant performance with simple calculations and manual data sampling, the early Operim system, designed by Wärtsilä Gas Solutions, aimed to help crews optimally operate large reliquefaction plants, reduce their 6 MW power consumption and keep the associated environmental footprint to a minimum. The cargo handling system, with a reliquefaction plant at its core, plays a significant role in the efficient operation of gas cargo tankers.

On a typical voyage from Qatar to Japan, for example, up to six tonnes of cargo per hour are managed by the reliquefaction process, and without careful operation and consideration of the varying operating conditions throughout the voyage via Operim, efficient operation would be compromised. With ever-increasing financial pressures on ship owners and operators, the need for operational efficiency is higher than ever before, which is why Operim has been updated to utilise the latest technology to support our customers and help them meet their business challenges.

SO, WHAT'S NEW WITH OPERIM?

Thanks to the increased availability of rich and near real-time data and upgrades to web and software interfaces, the application areas of Operim have widened beyond just LPG and LNG reliquefaction plants. Recent upgrades include land-based biogas, fuel gas supply systems and waste and water treatment solutions. Other processing assets will follow. Based on the widespread application areas of Operim, Wärtsilä has enhanced its Smart Marine Ecosystem strategy and is quickly developing new business models to support it.

For owners and operators, Operim enables a slew of cost-saving operating performance improvements in a continuous and dynamic fashion. Vessels are only as efficient as the way they are operated, and with Operim, inefficiencies and profitability impairments of all types can be identified and rectified to reach optimal operational efficiencies. Operim can, in a nutshell, constantly provide advice and insights on how to adjust working parameters in accordance with sea and weather changes as well as monitor maintenance routines and early warnings.

Used properly, Operim also can make money for users via cost savings. There are frequent developments in environmental compliance for individual ships and entire fleets that have to be managed, and that's just one of the myriad complex variables involved in running a fleet smoothly and efficiently while adjusting to different local conditions around the world. Operim helps synthesize all this data.

Additionally, as crews age and expertise and know-how are lost to attrition, newer crews need – and, in fact, require – data-rich environments in order to make accurate, fact-based decisions onboard ships.

AT THE CORE OF OPERIM IS A DIGITAL TWIN THAT ALLOWS THE SYSTEMS TO COMPARE ACTUAL PERFORMANCE AGAINST OPTIMAL PERFORMANCE.

DIGITALLY AUGMENTED AND INTEGRATED

But what really makes Operim a linchpin in Wärtsilä's Smart Marine Ecosystem is how it will become packaged and included in the sale of new physical hardware. In the foreseeable future, all of Wärtsilä's physical products could be digitally enabled this way as part of the brand promise. This is unique in the industry. It leverages Wärtsilä's broad portfolio and product heritage and is not easily replicated by new digital entrants to the market.

While the exact details of the new business model have yet to be disclosed, the general outline calls for Operim to be included in the price of a product – a desalination plant or a gas liquefying plant, for example – during the period of warranty, usually 18 months.

After that, a fee will be levied for the software in the same way software companies package their products and will have an opt-out function.

Wärtsilä's unique competitive advantage over pure software and data companies working only in the virtual space is that the company has in-house at its disposal the engineers who designed the machinery and can offer support in the form of a live chat functionality backed up by real-life expertise. This level of product understanding and support on a web interface is not just unique, it also strengthens the connection between the customer and Wärtsilä.

Digitally augmenting the product starts by enabling data collection. This can be achieved in several ways, depending on the configuration of the vessel and customer preference, by installing dedicated Wärtsilä hardware or using the vessel Integrated Automated System (IAS) system. Additionally, if the customer already has data in a cloud system, this also can be utilised. Once the data is collected, it enters the Operim cloud service, which features Wärtsilä's digital twin of the product being monitored.

A DIGITAL TWIN

At the core of Operim is a digital 'twin', developed with the help of product engineers and data scientists. This twin allows the systems to compare actual performance against optimal performance and ascertain areas for improvement.

These areas then can be visualised through dashboards in the form of KPIs and smart notifications for operators and crew members. They are accessible to the crew onboard the vessel as well as to the team onshore via a web-based dashboard hosted in the cloud, enabling the team members to use analytics and insight to monitor and improve the product performance.

From a user perspective, the interface is reliable and easy to use. A ship operator can easily access his fleet dashboard in the Operim system, which provides a near real-time overview of the operational health of the company's vessels, clearly outlined in red and green with average KPI indicators visible in a separate window.

VOYAGE REPORTING

One concrete example of Operim's usability is the voyage report and operation insight window inside the system.

For example, think about a gas cargo ship travelling between the UK and the US in the cold waters of the North Atlantic. Considering the temperature of the ocean, Operim can alert the crew to the need to pre-cool cargo such as liquefied gas when in cooler waters instead of waiting until the ship reaches warmer waters and using energy to cool the cargo then. This kind of precision was nearly impossible in the past without a very experienced operator and could be based at best on a guesstimate of the ship's position. Operim, however, can provide minute details about a vessel's route and assist with planning adjustments depending on weather, current, and water temperatures, to name just a few variables. The hope is that in the future, this functionality will lead to fuel savings based on different route positioning.

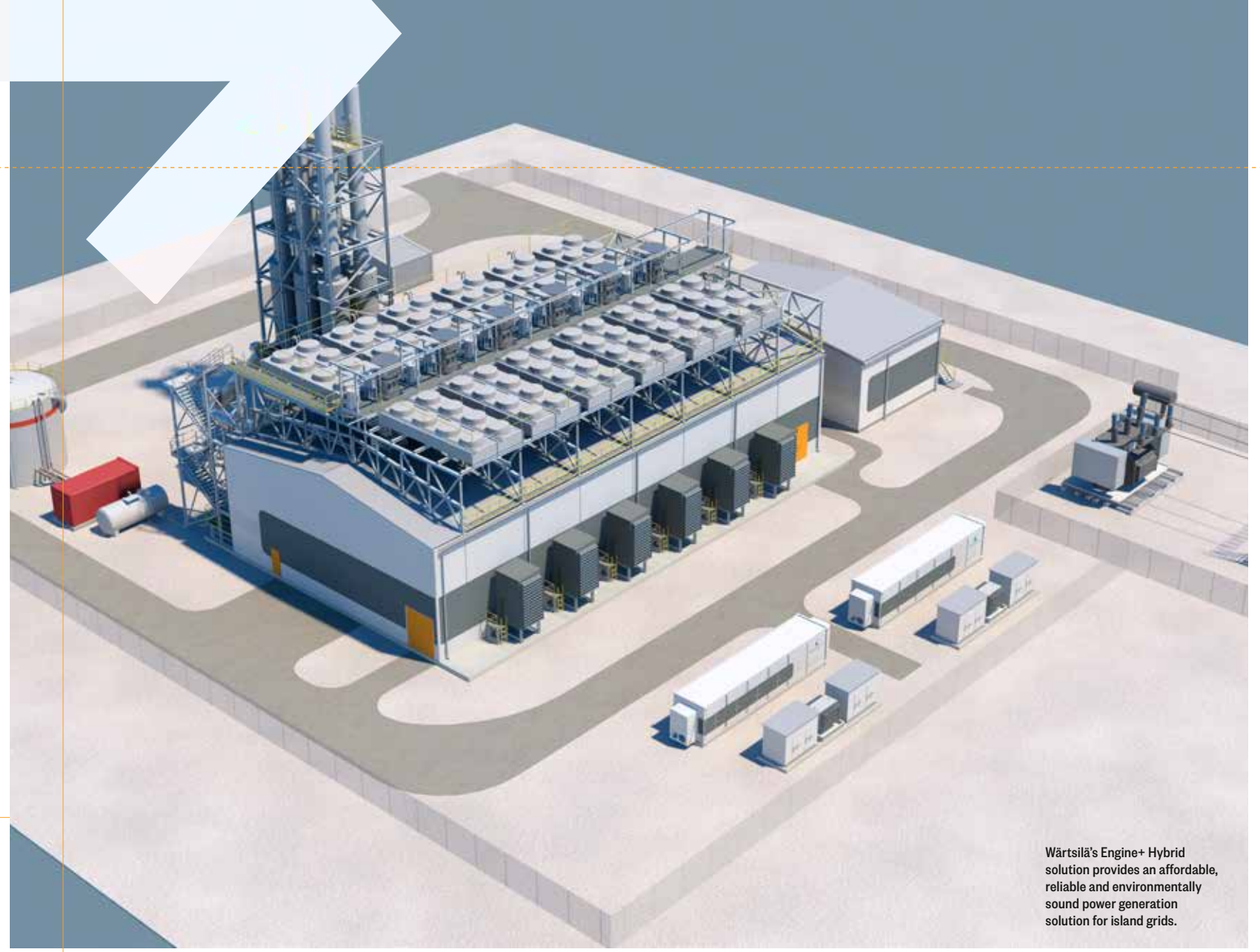
Future features will incorporate the automation of recommendations and utilise machine learning to complement the digital twin, providing richer insights. Operim will be enabled to interact with other Wärtsilä systems, such as Wärtsilä online and voyage planning products, allowing asset-specific optimisation to be considered in voyage planning.

Operim is central to Wärtsilä's Smart Marine Ecosystem approach to creating greater levels of efficiency, safety, and environmental sustainability as the maritime industry adjusts to meet the challenges of an emerging new era.

FUTURE-PROOFING POWER INVESTMENTS

▶ **TEXT:** PAYAL BHATTAR **PHOTO:** WÄRTSILÄ

IN A WORLD driven by hyper-connectivity, power companies need to keep pace with rising energy demand while being environmentally friendly. Wärtsilä's energy system integration solution 'Engine+ Hybrid' is an affordable, efficient, speedy, and reliable way to move towards a 100% renewable energy future using both old and new generation units.



Wärtsilä's Engine+ Hybrid solution provides an affordable, reliable and environmentally sound power generation solution for island grids.

In August 2018, Hungary's Sinergy Kft, a subsidiary of ALTEO group, began participating in the country's electricity market by providing frequency and secondary regulation to the national grid. The unit already had three Wärtsilä 34SG engines running on natural gas and was additionally powered by a Wärtsilä 6MW/4MWh Battery Energy Storage System (BESS).

The unit was Hungary's first energy storage installation, and it helped ALTEO increase its revenues and participate in the electricity trading market. It was also Wärtsilä's first integrated Engine+ Hybrid installation with Greensmith Energy's Management System (GEMS) (Greensmith Energy is a Wärtsilä technology).

Alejandro Schnakofsky, Director of Product Management, Energy Storage and Optimisation, Wärtsilä Energy Business, describes the system, which pairs a battery with a production unit to maximise efficiency and minimise fuel consumption, as similar to a hybrid car. He notes that technology plays an important part in the unit.

"Apart from hardware components, software plays a pivotal role in enabling this solution. GEMS leverages artificial intelligence – AI – forecasting and system condition learning to orchestrate energy resources in the power plant on a real-time basis," he says.

CUTTING CURTAIL

The Engine+ Hybrid solution replaces the traditional system of relying on spinning reserves to cover sudden changes in generation or load that produce inefficiency. The innovative GEMS platform enables producers to configure or reconfigure power plants with an optimal resource mix and help them achieve a wide range of goals, including increasing reliability, optimising operating costs and reducing environmental impact.

"Engine+ Hybrid explores the capabilities and possibilities of energy storage. It is just one application, but it is like a jack- of-all-trades that does many things at one time. Through this solution, we have touched upon several things, like spinning reserves, frequency regulation, and voltage control," says **Risto Paldanius**, Business Development, Energy Storage and Optimisation, Wärtsilä Energy Business.

Engines and battery energy storage are fully integrated into one power plant solution, the Engine+ Hybrid.

"These can lead to greater renewable penetration in the system because engines and energy storage are the most flexible generation assets that exist. When you add more renewables in power systems, variability increases. Engines and storage are needed to bring in more flexibility and enable this transition," he adds.

"ENGINE+ HYBRID EXPLORES THE CAPABILITIES AND POSSIBILITIES OF ENERGY STORAGE. IT IS JUST ONE APPLICATION, BUT IT IS LIKE A JACK-OF-ALL-TRADES."

ENERGY & INTELLIGENCE

Software plays a critical role in the Engine+ Hybrid system. GEMS leverages machine learning and sophisticated forecasting to predict operational conditions and optimally dispatch and control the resource mix while ensuring stability and reliability. It helps save engine running hours and maintenance costs and ensures optimal operations.

Here is how GEMS helps improve the efficiency of engine power plants by hybridising them:

Assume that a power plant with a load of 40 MW has five engines of 10 MW each. To ensure continuity in power supply in the event that one engine trips, the operator typically has to run all five engines at 8 MW output (80% load) rather than run four of them at full capacity. In this case, the fifth engine accumulates unnecessary running hours, resulting in higher maintenance costs. It also results in lower operational efficiency because the engines are running at less than full capacity.

In contrast, the Engine+ Hybrid model allows the operator to service the 40 MW load with just four engines running at full capacity and batteries for spinning reserve replacement.

Speed is of the essence in the Engine+ Hybrid solution. In the event an engine is tripped, the battery provides the power generation lost while the standby engine is automatically started by GEMS. Once the engine is up to speed and synced to the grid, GEMS automatically phases out the battery and slots the engine in, resulting in a full recovery of the system and avoiding a blackout.

"It is only through the orchestration offered by GEMS that this complex operation is possible. It controls the entire system from batteries and engines to renewable generation," Schnakofsky explains.

ENABLING 100% RENEWABLES

Schnakofsky says systems like these are critical to integrating a higher percentage of renewables in power generation.

"A world with 100% renewables is only possible with flexible and firm generation," he says. "Flexible engine power plants that can provide power in minutes will be pivotal to enable high levels of renewable energy penetration. This means engine power plants that can start and stop fast while maintaining a high operational efficiency will be in high demand to materialise a more sustainable energy system."

One example of how such a system has improved efficiency can be found on the small Caribbean island of Bonaire. Local energy provider ContourGlobal Bonaire has a 25MW power plant that generates energy using both engines (15MW) and wind (11MW). Until last year, this plant was generating between 12–15MW, with loads peaking at around 18MW during the summer. ContourGlobal was reported to be "curtailing wind because its engines were needed to provide additional spinning reserve for wind and also for sudden increases of electricity demand."

Late last year, Wärtsilä began integrating a 6MW energy storage system in this plant. Its Engine+ Hybrid solution included batteries and intelligent inverters along with access to GEMS for primary and secondary grid controls while integrating multiple power generation assets including existing wind, solar and storage capacities. By June 2019, the first phase of integration was complete, and the island no longer had to curtail wind resources.

Also thanks to the solution, renewable energy penetration has almost doubled, and the system is prepared for additional capacity to accommodate peak demand during tourist season.

MAXIMUM EFFICIENCY, MINIMUM COSTS

"We are hybridising engine power plants with energy storage even in cases where the engines may not be supplied by us but by competitors. Our solution is perfectly suited for island microgrids and remote industrial self-generation sites such as mines and cement factories," says Paldanius.

"Typically, the fuel cost in these places is quite expensive. What makes Engine+ Hybrid attractive for these users is the fact that it increases power system efficiency, i.e., utilises less fuel. There are cost savings also on maintenance and additionally lower emissions. These all are attractive attributes for short payback times on investments," he adds.

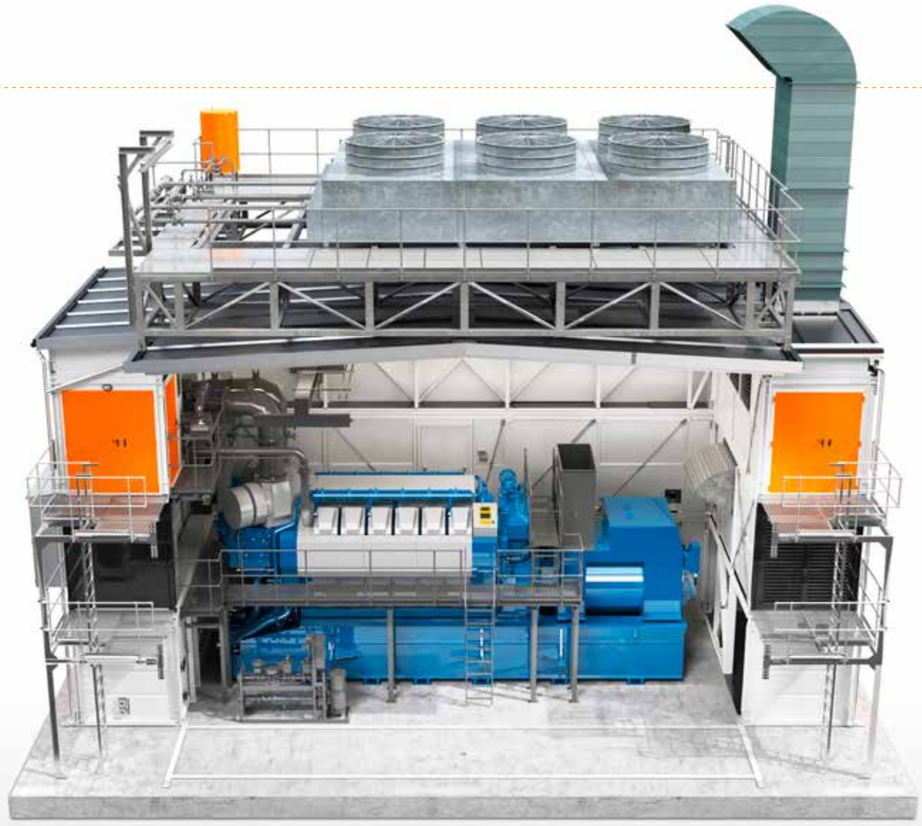
Engine+ Hybrid is a smart investment that helps power producers future-proof their assets and businesses. It is a next- generation solution that uses current technology in the quest to make a 100% renewable energy future a reality. Locations like Hungary and Bonaire are already realising the system's potential.

TOWARDS HIGHER EFFICIENCIES WITH WÄRTSILÄ MODULAR BLOCK

TEXT: ADAM RAJEWSKI **PHOTO & ILLUSTRATION:** WÄRTSILÄ

MEDIUM-SPEED COMBUSTION ENGINES have the highest efficiencies of all simple cycle solutions, can run on clean fuels, and their flexibility is unmatched. While they have different applications, from big baseload plants to local power plants to small combined heat and power plants, there are situations where these cannot be used. The new Wärtsilä Modular Block can change that.

ONCE ON SITE, THE MODULES ARE SET AND CONNECTED WITH SIMPLE BOLTED JOINTS, WITH NO WELDING REQUIRED.



A view inside a Wärtsilä Modular Block with a Wärtsilä 12V34SG engine. The engine-generator set is connected to auxiliary systems contained in the modules forming walls of the enclosure. Note the maintenance platforms and ladders, providing access to all components as needed for maintenance. The cooling radiators are installed on top of the Wärtsilä Modular Block, creating a fully closed engine cooling system, requiring no water supply.

Generally, two classes of reciprocating engines are used in the modern power industry: high-speed and medium-speed. The high-speed engines, typically 1500 or 1800 rpm (for 50 and 60 Hz systems respectively), have simpler designs. They are smaller, lighter, and also somewhat less expensive per unit output. On the other hand, the medium-speed engines (most typically 750/720 rpm, although there are designs with speeds like 1000 rpm or 500 rpm), are heavy-duty machines characterised by considerably better efficiencies, better dynamic performance, lower maintenance costs per unit of produced energy, and considerably longer service life. This comes at a higher investment cost and generally heavier and bulkier design.

Medium-speed engines are also larger in terms of single-engine output, as it is not feasible to build small engines of this class. Typically, the vast majority of commercially available engines below 5MW of output are high-speed designs, while those above 5MW are medium-speed units. All Wärtsilä engines, for instance, currently offered for the energy market are medium-speed designs.

Because of all these factors, medium-speed engines are typically used in larger commercial and industrial power plants, while really small facilities have to rely on less efficient high-speed technology. There are also some applications where both technologies may be a good solution, and the choice there depends on a project's specific requirements. There are, however, also situations where a project could greatly benefit from medium-speed technology but its deployment proves too complicated, forcing investors to satisfy themselves with the less-efficient option. This is because of the physical properties of medium-speed engines: they are relatively large and heavy.

So far, the main method of installing the medium-speed engines involves building a solid power house around them: quite a simple structure compared to other power generation technologies, but nonetheless requiring a considerable amount of engineering and time. In the case of commercial power generation projects, this typically does not matter, as engine power plant construction times are still much shorter than in case of other technologies. But there are applications where this need to build a solid power plant around the engines may prove prohibitive. Those can, for example, be facilities such as data centres or some industrial plants, where adopting a custom-designed power plant concept would require extending the construction time of the whole facility beyond acceptable limits. There are also situations where power generation is only needed for a limited time, for example, several years, and then assets need to be relocated.

Finally, there can be situations where for a variety of reasons it is desirable to minimise the amount and duration of on-site work, due to the cost of local labour, scarcity of qualified workers, or security concerns. All these may lead to a preference for inferior high-speed engine technology only because it can come to sites in an easy-to-install, containerised form.

GOING MODULAR

Wärtsilä has been facilitating the installation of medium-speed engine power plants for many years. This has led to standardised general power plant designs, standardised auxiliary modules and equipment, layouts, etc. This enabled very competitive delivery times even for large power plants. However, the need for building a structure around all this equipment, and the associated costs and time, still proved to be a challenge. The new Wärtsilä Modular Block is a way to overcome that barrier.

It is not possible to install a high-efficiency generating set inside any form of transportable one-piece enclosure – it is simply too big for that. In the Wärtsilä Modular Block, nearly all auxiliaries needed to operate a generating set are placed inside box-shaped modules already at the production facility. Modules are then transported to the site with the generating set and stacked around it, thus forming a modular enclosure.

The individual modules of the Wärtsilä Modular Block have a dual role: they are "process" modules containing process equipment, such as compressors, heat exchangers, valves, fans, air filters, pipelines, cables, etc., and elements of a weatherproof enclosure. Once on site, the modules are set and connected with simple bolted joints, with no welding required. The amount of on-site works is therefore considerably limited. It is only necessary to prepare a simple concrete foundation (the generating set's base frame is designed in such a way that it does not transfer any dynamic loads), with ducts for cabling, and embed in it a special positioning frame, which is a part of the Wärtsilä Modular Block delivery, and to which all other modules are later bolted. Then the actual modules are delivered as containerised cargo. Three modular walls are set up using three 'module layers' each, and then covered with a prefabricated modular roof, also supplied in containers.

After this partial structure is completed, the generating set is slid into the created chamber and connected to auxiliary systems, and finally the fourth wall is built, closing the module. Certain external systems still need to be attached, most noticeably a short exhaust duct with a stack and a fuel supply system (gas pipeline). The generator needs to be connected to an external medium voltage switchgear providing power off-take; this switchgear may be delivered as a prefabricated containerised unit. The Wärtsilä Modular Block can be used to build both a single-engine facility and a multi-engine power plant: further engines may be added with further extension blocks alongside the first one (as shown in Figure 3). In such a case, each new engine only gets three new modular walls and shares the fourth one with the previous unit, which reduces the cost and footprint of a multi-engine plant.

A multi-engine plant may be built in stages, and further modules may be added when the previous ones are already in operation, as all the auxiliary systems needed for the operation of the engine are engine-specific. It is worth emphasising that while the Wärtsilä Modular Block is a completely new design, in process engineering terms it follows the same general designs as standard Wärtsilä modules used in other power plants – they are simply spatially rearranged to fit the limited space of the modules. This means that although it is a new product, it relies on years of experience with proven process designs.

While the exact amount of time required will invariably change depending on site conditions, labour laws, the number of personnel (shifts) involved, and other local constraints, the assembly of a complete Wärtsilä Modular Block, excluding the foundation construction, may be accomplished within around five weeks. It also does not require specialised equipment, with a relatively simple crane being all the heavy machinery that is needed. Despite being very compact, the Wärtsilä Modular Block is designed to ensure easy maintenance of the engine. Personnel access is provided to all components that require human intervention at any stage of a plant's

A site with five Wärtsilä Modular Block Compact units, each with a Wärtsilä 12V34SG engine. All units are connected and share their middle walls but remain functionally independent. The stand-alone building in the lower-right corner is a medium voltage switchgear building used as a point of interconnection between the generating sets and the public power grid.

Outputs of generating sets available for the Wärtsilä Modular Block

GENERATING SET TYPE	50 HZ	60 HZ
12V34SG	5,838	5,587
16V34SG	7,832	7,496
20V34SG	9,800	9,389

THE WÄRTSILÄ MODULAR BLOCK CAN BE CUSTOMISED TO A CERTAIN EXTENT TO MEET REQUIREMENTS OF A SPECIFIC PROJECT.

lifetime. As is standard in other Wärtsilä power plants, the engine and generator remain within the block during operation and are never removed from the site for maintenance – only engine components are replaced or transported to a local Wärtsilä service workshop for reconditioning, as prescribed by the engine maintenance manuals. Each engine cell is also provided with an overhead travelling crane with a capacity sufficient to lift all engine components that might require replacement during overhauls. Doors and laydown areas are provided, so it is not necessary to dismantle the enclosure for scheduled maintenance. Dismantling is, however, perfectly possible, in case the owner wants to relocate (or sell) the plant at some point in the future. This makes the Wärtsilä Modular Block a good product for medium- and long-term rental; after dismantling all the components, except for the concrete foundation, it may be transported to another site and reassembled.

THE ENGINE

In its current form, the Wärtsilä Modular Block is designed for the Wärtsilä 34SG spark-ignited gas engine and can accommodate three different cylinder configurations of that engine: 12V, 16V, and 20V. The 12V configuration uses the so-called Wärtsilä Modular Block Compact, while the 16V and 20V are installed within the Wärtsilä Modular Block Extended, characterised by longer side walls, to accommodate the longer engines.

The Wärtsilä 34SG is currently the most popular medium-speed gas engine in the world. It is characterised by very high efficiency, low environmental footprint, and ultimate flexibility. A standard engine of this type can reach full power from standstill in just two minutes, and a specialised version for data centres, which is compatible with the Wärtsilä Modular Block as well, can do so in less than one minute. Thanks to this feature, a Wärtsilä Modular Block can be used as a clean alternative to emergency diesel generators for critical infrastructure such as data centres, hospitals, or airports.

Thanks to its clean fuel and low emissions, such a backup generating set can also be used for regular power supply either alone, together with the grid (generating power whenever grid electricity prices go up), or in conjunction with local renewable resources (firming up wind or solar power generation).

THE OPTIONS

While the Wärtsilä Modular Block is a highly standardised prefabricated product, it nevertheless can be customised to a considerable extent, to meet requirements of a specific project. Customisation options include:

- Selection of engine cylinder configuration and output, as well as the number of generating sets;
- Adjustment of generator voltage in frequency to the local power system (same options as for standard Wärtsilä engines);
- Selection of fuel (options including natural gas, liquefied natural gas, biogas or ethane);
- Optional use of selective catalytic reduction (SCR) technology with an outdoor reactor to further reduce NO_x emissions;
- Heat recovery from exhaust gas using an outdoor exhaust gas boiler;
- Automated lubricating oil replenishment system;
- Remote plant operation and monitoring through a secure gateway.

In its current form, the Wärtsilä Modular Block is designed for sites with ambient air temperatures from -25 to +40°C. The design follows relevant European (EN) standards for structures, and EU directives for pressure equipment and electrification. The modules are manufactured in the European Union.

IN CONCLUSION

With the Wärtsilä Modular Block, investors for whom a simple, standardised and quick on-site installation process is critical, get access to the highly efficient medium-speed engine technology. This new innovative solution enables the construction of even bigger power plants with ease, with minimal amount of project-specific engineering. This makes it an attractive option for various projects where high-speed engine technology with its inherent lower efficiency used to be the only possible solution. It may also be a cost-effective alternative to standard power plants with medium-speed engines in those locations where site works are expensive, and reduction of installation time can bring cost savings to the entire project.

TEXT: LARA MCGOY **PHOTO:** WÄRTSILÄ

SEA20: Marine cities join together for change

SEA20 launched with a 'wake-up call' to the world's major marine cities to confront the challenges of a moment where rising sea levels are disrupting the social compact at both the local and global levels.

Isabelle Thibault-Ahlström, Communications Manager, Wärtsilä Marine Business, says the first year of this powerful initiative was focused on engaging communities to take action that will determine the future of the marine ecosystem.

"The most important part of the movement during the last year has been to make societies understand how important a Smart Marine Ecosystem is for their future," Thibault-Ahlström says. "Consequently, it is a way to put pressure on the entire value chain of the marine industry, leading it to more openness, broader co-operation, better connectivity, collaboration, and more ambitious undertakings."

So far, eight jurisdictions have signed on to the initiative. The goal of the organisers is to have 20 members on board by the end of this year.

The SEA20 initiative, run by Nordic West Office – a global affairs consultancy and think tank – and enabled by Wärtsilä, is part of the broader 'An Oceanic Awakening' movement. An Oceanic Awakening was presented at the World Climate Summit-Investment COP in Katowice, Poland in 2018 to great acclaim. At the summit, the initiative was praised for bringing the human element to the center of high-level discussions about how to save the seas to the benefit of industry, society, and more importantly, the planet.

SEA20 built upon that element of interpersonal connection at an initiative-wide meeting held in Helsinki in June. Politicians and industry leaders came together with analysts and activists to identify tangible solutions to sustainable maritime issues.

Continuing the momentum from that meeting, in December 2019, the initiative released a global analysis of the future of maritime cities and industries focused on ways stakeholders can work together to solve the challenges facing the marine environment. The report is available for download at sea20.org/study.

Thibault-Ahlström says that cooperation is key to the initiative's success. "There are so many industry stakeholders working independently trying to achieve their own objectives, both at sea and on shore. We must enable and create processes where stakeholders can collaborate towards common goals, which can accelerate change.," she says. "We're very proud of this global initiative and look forward to seeing its impact manifest in the years to come."

*Sign off

[AT YOUR SERVICE]

From big data come big ideas

TEXT: LARA MCCOY **PHOTO:** BENJAMIN SUOMELA

SINCE JOINING WÄRTSILÄ a year ago as General Manager of Business Intelligence, **Andrei Voinigescu** has worked to apply his experience with digital platforms and emerging business models to the marine segment.

"THE MORE DATA WE ARE ABLE TO COLLECT, THE BETTER WE ARE GOING TO BE AT OPTIMISING OPERATIONS."

1 LOOKING AHEAD TO THE NEXT 10 YEARS, WHAT DO YOU THINK ARE THE KEY TRENDS THAT WILL IMPACT SHIPPING IN THE COMING DECADE?

One thing that's going to be a big factor in the 2020s is the transition towards LNG as a fuel source beyond the cruise and ferry segments to container ships, cargo ships – the merchant fleet as a whole. There's also going to be more emphasis on the use of "big data" – software and data-driven operational excellence, voyage optimisation, and fleet utilisation optimisation solutions for reducing energy usage.

Another very interesting potential trend to monitor is whether we have reached peak globalisation in trade flows of physical goods. Are we going to continue to see growth in tonnage being shipped worldwide over long distances, or are we going to see more inter-regional trade, with manufacturing shifting closer to where goods are being consumed?

2 THERE HAVE BEEN A NUMBER OF STUDIES SHOWING THAT CONSUMERS ARE BECOMING MORE AWARE OF THE IMPACT OF THEIR OWN CHOICES ON THE ENVIRONMENT. DO YOU THINK THERE'S ANY WAY CONSUMERS CAN INCREASE PRESSURE ON THE SHIPPING INDUSTRY?

I think right now there is a lack of transparency in terms of the actual carbon impact of something you might order online.

I think it's beneficial for companies like Wärtsilä to be a part of that conversation, because the more transparency there is into the amount of greenhouse gas emissions that are being attributed to the shipment of these products, the more pressure end customers can put on the different parties along the supply chain to adopt more environmentally friendly solutions, and ultimately we are a solution provider. We're here to provide LNG engines or navigation solutions that allow ships to reduce their overall energy use. I think we could be taking a more active role in highlighting to our customers that there is end-user pressure here, and we can already provide concrete solutions that reduce greenhouse gas emissions today.

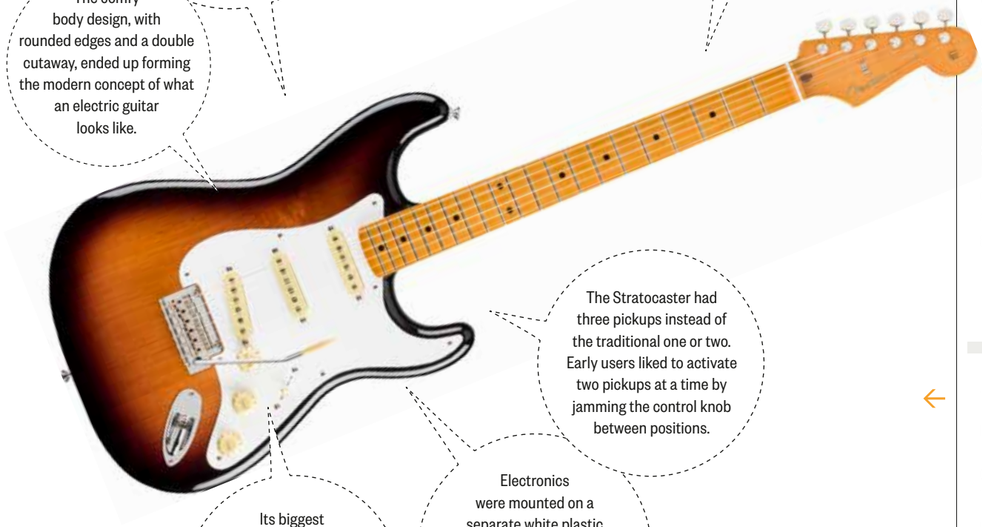
3 YOU HAVE A COMPUTER SCIENCE BACKGROUND. HOW CAN BIG DATA, INCREASED DIGITALISATION, AND AI HELP THE MARINE INDUSTRY BECOME MORE ENVIRONMENTALLY FRIENDLY?

I always try to boil down problems to efficiency or optimisation problems. For the past couple of years, we've been exploring ways we can optimise the existing operations of our customers. The more data we are able to collect, the better we are going to be at optimising operations.

PHOTO: FENDER

[CLASSIC]

Let 'er riff



The original yellow-and-black sunburst paint pattern was meant to give the guitars an upmarket look, but also hid the mismatched wood grain where pieces had been glued together.

In 1967, Jimi Hendrix made a name for himself by torching his Strat on stage. Later it came out that the victim was actually a cheap stand-in.

The comfy body design, with rounded edges and a double cutaway, ended up forming the modern concept of what an electric guitar looks like.

The Stratocaster had three pickups instead of the traditional one or two. Early users liked to activate two pickups at a time by jamming the control knob between positions.

Its biggest innovation was the string-bending vibrato bar, which opened the door to the wild pitch variations that became popular in '60s rock.

Electronics were mounted on a separate white plastic pickguard, enabling the entire pickup and control assembly to be dropped into place and screwed on.

ORIGIN

The practice of 'wiring up' acoustic instruments was nothing new in 1954, but when a California-based electronics tinkerer rolled out the first **Fender Stratocaster** that year, he unknowingly created an icon that would change the face of music forever. Since then, the 'Strat' has been the ax of choice for countless rock legends and inspired generations of garage-band dreamers.

TECHS & SPECS

Designer
Leo Fender, Bill Carson, George Fullerton, Freddie Tavares

Production
1954 – present

Materials
Ash (later alder) body, plastic pickguard, rosewood neck

[CULTURE WATCH]

[SCIENCE]

LANCASTER UNIVERSITY

The debate about which is the coolest LEGO® in the universe has finally been settled. Late last year, a team of ultra-low-temperature physicists at Lancaster University placed a mini-figure and four bricks inside their dilution refrigerator, cooling them to just above absolute zero. The experiment, detailed in *Scientific Reports*, surprisingly found that the toys' ABS plastic could make an effective, low-cost insulating material for such fridges, which are crucial to the development of quantum computing.

[LITERATURE]

Is all the tech-driven disruption out there giving you jitters about job security and the fate of the world at large? Don't panic. In his new book *The Passion Economy: The New Rules for Thriving in the Twenty-First Century*, award-winning economics journalist **Adam Davidson** shines a light on today's unprecedented opportunities to make money doing what you love, with inspiring stories of people who have created their own weird and wonderful paths to professional fulfilment.

[TECHNOLOGY]

In the 'sounds like sci-fi' department, Delta Airlines has announced that it will launch a trial at the Detroit Metropolitan Airport this year of a system that allows hundreds of travellers to simultaneously look at the same digital display and see different, personalised flight information. Developed by the start-up Misapplied Sciences, the new Parallel Reality displays use precision spatial calibration and a new kind of pixel that can output millions of controllable rays of different colours and brightness. No special glasses needed.

TEXT: ANNE SALOMÄKI **PHOTO:** ST1

The founder and principal owner of energy company St1, which owns and runsmore than 1300 service stations in three countries, Mika Anttonen sees carbon markets and renewable energy innovations as a way out of our current situation – which, as he sees it, is getting more and more dire by the day.

Mika Anttonen doesn't think he's painting an ugly picture when he says that we can't reach our common goal of limiting global warming to 1.5 degrees. Despite all commitments and signatures on climate deals, he wants to remain a realist.

It's simple: we just don't have enough time left.

"I don't think it's in any way possible, and I think it's good to admit it," he says. "There are people, particularly abroad, who are sceptical about the whole thing. If they find evident impossibilities in the story, they'll use it as an excuse to do nothing."

And doing nothing is, in Anttonen's view, the worst option. If anything, right now we must do the right thing. This would be to focus on the actions that have real impact and develop technologies that work anywhere and everywhere.

For example, a carbon market would direct the costs of fixing climate change to those who are most responsible for causing it: fossil fuel producers. Through the market, those producing carbon dioxide emissions would pay for doing so, and those either reducing them or adding to carbon sinks that store the already emitted carbon could be compensated.

"Companies have the money and capabilities to make the changes. States don't."

PUT THE MONEY WHERE IT MATTERS

Anttonen emphasises that we need to look at the atmosphere as something we all share together, and that our playing field is the entire world. This needs to be considered when developing new technologies, too. At this stage, local actions aren't sufficient.

"It doesn't make sense to put money and effort on solutions that only work within the borders of Finland, the Nordics, or other small regions," Anttonen explains. "Scalability is key."

This is one of the reasons Wärtsilä, St1, software and services company Tieto, state-owned energy company Fortum, and independent think tank Demos Helsinki have launched the Innovation Community Initiative. The group's aim is to dramatically accelerate the global energy sector's transition to more environmentally sustainable production through collaboration instead of competition.

Anttonen prefers solutions that both reduce carbon emissions and function as carbon sinks, as their benefits would be two-fold. Those are the most important and essential alternatives – the ones worth investing in.

"This is not an exercise we've got a limitless supply of money for, no matter what is being said," says Anttonen.

Anttonen believes that many people are disillusioned as to what really makes a difference. Biofuels or electric cars are generally deemed "good choices" but don't necessarily reduce the consumption of crude oil one bit.

"I can make a list of our current measures that make people think they're doing good – but it isn't true."

WE'RE NOT EVIL, WE'RE JUST MANY

Despite ongoing and increasing investments in renewable energy, the demand for fossil fuels is constantly growing. Anttonen points out that it's a struggle to respond to this growth with renewable sources, let alone replace fossil fuels when it comes to the existing demand.

Anttonen notes that the growing demand for energy isn't anyone's fault.

"It's not because we're all evil people on the planet, but because our number is growing at an incredible pace. Every 15 years there's a billion more inhabitants on the planet, and that's a number with nine zeros in it," he says. "No matter how low their level of consumption is, in megajoules, it is immense."

Thus, we also must comprehend the scale of the actions that are needed. Anttonen says even if all factories were blasting at full steam and every capable engineer was working day and night, the speed wouldn't be sufficient to meet the demand.

CARBON IS EASY

The global target of reducing carbon emissions to 580 gigatonnes is as much out of our reach as the 1.5-degree goal. Anttonen doesn't think this is an irreversible disaster, as although the amount will be exceeded momentarily, there are ways to reduce it.

"This is not a game that will end in 15 years and then we'll all slash our wrists. This carbon dioxide problem is very much solvable, and I believe we will solve it."

Anttonen believes that technologies and innovations will, eventually, lead us to improvements. However, he notes that carbon is one of the easiest aspects. The impact climate change can have on biodiversity is much more unpredictable than counting emissions.

"No scientist has been able to come up with a model that could reflect on the shocks in our food supply chain when pollinators disappear. As the number of people as well as consumption climbs higher, nature will eventually hit back."

"IT DOESN'T MAKE SENSE TO PUT MONEY AND EFFORT ON SOLUTIONS THAT ONLY WORK WITHIN THE BORDERS OF FINLAND."

[AMBITION]

"The 1.5-degree target is already beyond us, but we shouldn't give up on climate change."

Mika Anttonen says that to solve climate change, we have to focus on actions that have real impact.

[THE GEAR]

Of the hordes of smart cases out there, the one most likely to make 007 blush is the ultra-sleek **Samsara Carry-On**. Made from lightweight aluminium alloy, it features a sophisticated tracking system, removable power bank, interior lighting, and a flat top that doubles as a work surface. It is also fireproof.

Ironing and re-ironing not part of your travel agenda? The **Packshi Shirt Carrier** offers a shortcut to keeping clothes wrinkle-free throughout your entire journey. The hard, nylon-covered case comes with a custom folding pad and even illustrated folding instructions for the laundry-impaired.

Snoozing while seated just got a little easier thanks to the **Ultimate Travel Pillow** by Travelrest. Billed as the only inflatable pillow offering full lateral support, it can be positioned across your torso or down your side. As a bonus, it looks less silly than most other anti-head-flopping devices out there.

TEXT: STEVE ROMAN

[LITTLE ENGINEER]

One small step for coding

THE COMPUTER ABOARD APOLLO 11 may have had less number-crunching capacity than a Furby, but that doesn't change the fact that the astronauts would have never made it off the ground without the help of those unsung heroes – the coders. It's a lesson you can use to inspire your Little Engineer to begin exploring the world of coding and sharpening their problem-solving skills. If that doesn't work, try showing them this really cool-looking rocket.

Created by US-based LetsStartCoding.com, the award-winning Code Rocket is designed to introduce 8-to-12-year-olds to the basics of C++ programming through a series of 20 fun challenges. Using your home computer, which will be tethered to the rocket via USB cable, your budding mission control specialist will figure out how to fade the rocket-booster LEDs, send Morse code light messages, sound off the laser blasters, count down to lift-off, and more.

The kit includes the rocket (eight programmable lights, a speaker and two switches), the retractable USB cable, reference cards for code concepts like loops, functions, and 'if' statements, and a sturdy carrying case. Code Rocket's free downloadable software includes helpful examples and lets you skip the boring setup steps. The company also sells more complex circuit-building and coding sets that could come in handy once your child has outgrown the space academy.

PHOTO: MARJA VÄÄNÄNEN

Increasing circularity in the maritime economy

THE CIRCULAR ECONOMY IS PART of the lifecycle approach also in maritime, but too often discussions of circularity come in very late in the process. As all segments of the maritime economy face pressure from both regulators and end users to be more environmentally friendly, it is critical that circularity becomes part of the conversation throughout all phases of an asset's lifecycle.

We are all familiar with the concept of recycling, and certainly this is an improvement over the throwaway society of the past. Moving forward, however, we need to have a means of introducing materials back into the production process, reducing the amount of waste in the environment. Circularity is a major part of that.

We typically speak about energy effectiveness, but now we need to learn a new phrase: material effectiveness – extending the life of existing assets. This means we will use fewer raw materials and make sure that they are returned to the material flow.

ALTHOUGH IT'S CRITICAL TO INCLUDE discussions about circularity at the beginning of the lifecycle, we also have the opportunity to extend the life of assets mid-life. We can convert ships currently in operation through lengthening and improving ship systems, thereby increasing capacity and reducing emissions per unit of transport. If we can extend the life of some vessels by 10 years, we can start taking action today rather than waiting for the future.

There is a strong business case to be made for circularity, from both the perspective of maximising investment and responding to public pressure. From the investment side, if you can lengthen the lifespan of an asset, you increase your revenue potential and also reduce capital expenditures on new assets. And these lifetime extensions have much less risk than new builds. You are making a decision today that will start paying back tomorrow. From the consumer perspective, embracing circularity is an indication that you are taking action to reduce emissions and preserve the environment.

THERE IS NO SILVER BULLET we can use to fight climate change in the maritime ecosystem, but circularity is one more solution in the portfolio. By considering material effectiveness at all phases of the lifecycle, we can introduce the flexibility required to keep ships in operation longer and hedge against uncertainty in the market.

Too often we in the maritime business judge ourselves too harshly on our performance, and of course there is still much progress to be made, but we are taking the right steps in terms of both recycling material and extending the life of assets. By embracing circularity, we can leave a positive handprint in the global value chain.

Vesa Marttinen
Director
Cruise & Ferry
Wärtsilä Marine Business