



Twentyfour7.

Wärtsilä Stakeholder Magazine

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Wärtsilä Stakeholder Magazine*

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editorial



Wiring up positivity

WHILE 'CARPE DIEM' MIGHT BE a very tired expression, it is an excellent piece of advice. Keeping one's mind open and bravely jumping at opportunities as they occur enables innovation, ideation and implementation of ground-breaking initiatives.

Today, the rapid development of information technology provides unprecedented opportunities for collaboration. Wärtsilä is committed to seize the moment and we aim to be a driving force in the process of creating a clean, smart and sustainable future. In doing so, we invite others in the market to become part of the development. Our Smart Marine Vision and Smart Energy Vision are guidelines to futureproof solutions and our ways of working.

In maritime transport, we envision an ecosystem where ports, fleet operators, logistic companies and others share data, enabling efficient and clean operations. An oceanic awakening is coming, and we are not alone in thinking so. Importantly, policymakers are also joining forces. In April, the International Maritime Organization adopted an initial strategy for phasing out greenhouse gas emissions in international shipping, aiming to reduce CO2 output by 50% by 2050. At Wärtsilä, we are committed to speeding up this development to curb climate change and secure a clean maritime environment.

Also, the energy industry is taking leaps towards sustainability, with increasingly many societies opting for clean power sources. The International Energy Agency (IEA) estimates that renewable electricity generation will increase by more than a third by 2022. In the next five years, IEA estimates that wind and solar power will represent more than 80% of global renewable capacity. Wärtsilä is tapping into the opportunities with growing focus on solar solutions (p. 62) while integrating the available power mix with software. In the long run, we want to lead the transition to a 100% renewable energy future. (Find out more about our direction on p. 13.)

In addition to supporting the transition to renewable energy production, we must have everyone on board and equip new generations with the right kinds of tools, skills and mindsets to take an active role in creating a sustainable future. For example, we collaborate with local, educational institutions in Senegal (p. 14), involving other key stakeholders as well. Future generations are not only our children, but also our future workforce, customers and partners.

Thus, we should indeed *carpe diem* – but let's make sure it is done in a sustainable way.

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Wärtsilä Stakeholder Magazine*

[SNAPSHOT]

Sailing back to basics

NO GPS, NO MOBILE PHONE, no sports watch – and not a single CD. In July, Finnish sailor **Tapio Lehtinen** left behind all modern conveniences to spend nine months at sea as part of the Golden Globe Race. This year marks the 50th anniversary of the competition. Its rules ban the use of any technology or boat types that weren't available in the original race in 1968. Thus, Lehtinen's plentiful sailing experience will be valuable if and when the sea gets rough.

"A skilled sailor manages challenges which a wise sailor may never have to face," he told Wärtsilä before the race began. "Strength alone isn't enough; one also needs wisdom and experience."

Lehtinen set sail from Les Sables d'Olonne in France. As his key partner for the race, Wärtsilä has been closely following his adventure.



around the globe

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

Being sustainable when the world is in a flux

In a world where ice-caps are melting fast while state-heads deny climate change to be real, it becomes even more important for corporates to come forward and cooperate towards a more sustainable future. Here, the marine and energy industry may have a bigger role than others.

HISTORICALLY, GLOBALISATION HAPPENED at port, which is where cities grew. However, this dependence on the sea for trade and exchange is no longer a driving force in shaping marine metropolises. Proximity to the sea no longer defines a city's socio-economic prowess. Rising sea levels in the age of global warming has meant that marine city urbanisation now carries the risk of damage and vulnerability. We've all seen the widespread devastation caused by hurricanes and severe flooding. Records show that over 600 million people live in coastal areas that are within 10 meters of sea level. Major cities such as London and New York already require storm-surge defences and will need more if sea levels rise further. Climate change affects us all to such an extent that building resilience in city infrastructure must become a global priority. So far, it looks like the world is losing the war against climate change, unless some quick action is taken.

The current seismic shift in world order, whether hailing from China's aggressive expansion plans through the Belt & Road Initiative or looming trade wars stemming from Trump's protectionism, will undoubtedly impact cash flow and how or where humanity can respond to environmental and societal challenges. With established trading systems transitioning, it's time to find new ways of working together in the creation of sustainable globalisation. The UN estimates that 66% of the world's population will live in urban areas by 2050. Challenges in meeting the needs of a proliferating world population pertain to increased demands on natural resources.

Technology and data-driven solutions are changing the identity and functionality of cities, but we

are also seeing the formation of new strategic alliances. For instance, the C40 megacities network, the ICLEI city alliance, or cliques like the BRICS grouping and the RCEP who together, often in secrecy, decide on rules and investments that lead to new powerplays challenging the nation-state versus the city dependencies. This is heralding a new era with a revised system of governing networks. To remain competitive, cities will have to get political while global inter-city relations will have to be fortified.

In a world where globalisation is going digital, the convergence of new information technologies is becoming the only way to ensure open and efficient subsistence among individuals, companies and cities. But in facing a rising tide of crises – environmental catastrophes, exponential population growth, compromised democracies, food shortages, mass migration, we are frankly not moving fast enough to address these escalating problems. Sustainable urbanisation is key to successful development and Wärtsilä wants to bring Smart Marine and Energy Solutions into the fold.

WE ALL KNOW THAT SHIPPING needs to deliver its share towards global climate change efforts under the Paris Agreement. IMO regulatory work and capacity-building initiatives are proactively addressing GHG emissions from international shipping. But the future of the Marine Industry is not so much about ships, as it is about improving global transport for a world in flux.

Wärtsilä understands that developing a Smart Marine Ecosystem is all about handling change

TEXT: LAURA QUINTON PHOTO: WÄRTSILÄ / TOMMY TENZO

SUSTAINABILITY AND CONNECTIVITY ARE SIMPLY TOO IMPORTANT TO BE IGNORED.

in decades to come. From managing the shipping cycles, adapting to new regional and global trade structures, to engaging with emerging global B2B market places, solving the need to transport ever more cargo and increased people flow, all with a zero-carbon response to climate change. The Amazons, Ubers, Alibabas of this world are up-ending existing business models, melting ice is opening new arctic shipping routes. Autonomous vessels, renewable energy, remote control shipping, smart ports, route optimisation, predictive maintenance, open data, big data analytics, AI, blockchain, quantum computing, nanotechnology, IoT, drones, space-based services... it's not science fiction, folks – it's all happening now.

Smarter shipping management will be required to plug marine businesses in to the fast-emerging digital infrastructures that are developing on dry land. On the horizon lie Smart fleets using technology to run sea transport factories and storage solutions. We're seeing more focus on general cargo, and specialised logistic-related transport. 'Click and collect' B2B services are becoming the focus of global transport. The leap to create a true Smart Marine Ecosystem remains a significant one requiring collaboration and co-creation across multiple segments and industry verticals – it is not a single brand's responsibility but a joint endeavour that will require widespread endorsement, support and active involvement.

WÄRTSILÄ ISSUES A WAKE-UP CALL for the marine and energy industries to act now!

'An Oceanic Awakening' is a global movement, initiated by Wärtsilä, focused on radical transformation of the world's marine and energy industries into one supremely efficient, ecologically sound, digitally connected and collaborative ecosystem. This movement, unique in its approach, will demand widespread participation and active involvement well beyond the maritime sector. To kickstart talks, Wärtsilä has established SEA20, an international forum for the world's foremost Smart and Ecologically-Ambitious marine cities. Key to global cooperation is trust and commitment. SEA20 is about building long-lasting relationships to drive action and create the right space for decision makers to sculpt this massive series of developments. Wärtsilä has issued an invitation to the world's most important, forward-looking marine cities, to not only acknowledge this 'wake up' call but pledge their involvement in doing something about it, together!

Wärtsilä is set to play an instrumental role in brokering new agreements across land and sea. With the most complete marine portfolio in place – including newly acquired competences to help digitalise its

services and connect vessels to ports and beyond – our Brand is in the ideal position to drive this change forward.

"Our solutions have been addressing sustainability needs in the maritime industries for some time," says **Kari Hietanen**, Wärtsilä's Executive Vice President, Corporate Relations and Legal Affairs. "But 'An Oceanic Awakening' demands change on a far wider scale. It's time for the world to wake up to the genuinely transformative potential of the marine sector, and the role its rapid development will play in each of our lives."

With the launch of SEA20, Wärtsilä has initially invited the cities of Hamburg, Helsinki, New York, Rotterdam and Singapore to state their willingness to rethink their role in marine ecosystems, accelerate the inception of practical solutions, hasten the spread of best practises, actively adopt and promote new technologies, and legislate new smarter ways of doing business across our oceans. How can cities best take advantage of a Smart Marine Ecosystem and all its cascading benefits? How should we be pivoting marine business to safe-guard its future profitability without compromising on sustainability? How can we better establish synergies between Smart City and Smart Marine development?

"We simply cannot afford to wait for the marine and energy industries to evolve at their own pace," says Wärtsilä's President & CEO **Jaakko Eskola**. "The calls for greater efficiency, sustainability and connectivity are simply too important to be ignored. Rapid acceleration to benefit the entire sector, as well as society at large, is urgently required, and 'An Oceanic Awakening' is our wake-up call to everyone, heralding the beginning of our journey in making the future of shipping and energy a reality."

'An Oceanic Awakening' is about identifying market failures that are holding humanity back and using the SEA20's collective intelligence in tailoring sustainable solutions. Those who execute first may gain the important competitive advantage as individual companies or clusters, as cities or even as countries. Transformative changes often come when there is some momentum, which visionary innovators can latch onto; therein lies the ethos behind SEA20. Welcome on-board! ●

News

TEAMING UP IN SINGAPORE

Wärtsilä has made friends in Singapore: in April, the company first announced a partnership with the Maritime and Port Authority of Singapore (MPA), and only a day later, another with cyber security company Templar Executives.

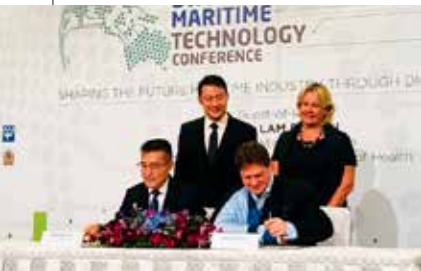
The collaboration with MPA aims to promote maritime innovation and R&D, and it covers four different streams: digital acceleration, cyber-physical security, intelligent vessel and port operations. The two organisations have agreed to support and leverage start-ups and SMEs in Singapore in the four fields.

Wärtsilä and MPA will also educate and create awareness on maritime technologies as well as synergise and showcase activities across both the MPA Living Lab and Wärtsilä Digital Acceleration Centre (DAC).

With Templar Executives, Wärtsilä has established a world-class cyber academy, offering courses designed to support and enhance the collective cyber maturity of the shipping community, notably operators and owners. The academy's courses will cover topics ranging from cyber security coaching for senior management to cyber awareness for all organisational levels.

Through the groundbreaking initiative, the organisations contribute to sustainable cyber security solutions across the maritime sector by, for example, building a cyber security reporting portal for the sharing of threat intelligence.

The academy, hosted at the Wärtsilä DAC in Singapore, delivers courses in Singapore and London. The parties will also co-operate with key stakeholders, including the Singapore government.



EXCITEMENT
RESPECT AND TRUST



USA: Virgin Voyages, a joint venture between Sir Richard Branson's Virgin Group and Bain Capital, has assigned Wärtsilä maintenance responsibility of three of its cruise ships. "Wärtsilä's outstanding reputation for high-quality service and our shared values for environmental consciousness made them the ideal fit," said Stuart Hawkins, Senior Vice President, Marine & Technical Operations, Virgin Voyages. Wärtsilä's Dynamic Maintenance Planning will remotely analyse performance data real-time and carry out maintenance. This makes it possible to extend service intervals, thereby reducing unnecessary downtime.

ENERGY
MAKE THINGS HAPPEN



NORWAY: Wärtsilä and Norwegian company Wilhelmsen Ship Management have signed a five-year agreement covering the maintenance of exhaust gas cleaning systems installed in three vessels managed by Wilhelmsen. The agreement ensures that the vessels are fully compliant with the International Convention for the Prevention of Pollution from Ships and can fulfil the International Maritime Organization's new sulphur limits coming into force on 1 January 2020. All three vessels have a 25 MW Wärtsilä Hybrid Scrubber System, which has the flexibility to operate in both open and closed loop, using seawater to remove SOx from the exhaust gas.

Wärtsilä
GLOBAL
WATCH



SENEGAL: Wärtsilä has been chosen to engineer, manufacture, and deliver a 130 MW Flexicycle plant in Mbour. The order for the Malicouda power project in Mbour was placed by Matelec, the contractor. The project is part of Senegal's strategy to increase its energy production and reduce the cost of electricity for consumers. The plant will initially operate on seven Wärtsilä 50 engines using heavy fuel oil, but with an option to convert to gas as soon as it becomes available.

DO THINGS BETTER
EXCELLENCE

DIRECTION: SUSTAINABILITY

TEXT: ANNE SALOMÄKI PHOTO: 123RF

Wärtsilä has built a compass that guides the energy sector to a future that runs on renewables. The company's energy vision paves the way to an industry-wide transformation.

THE TECHNOLOGIES NEEDED for a fully renewable future of energy are already in existence. Now, Wärtsilä is harnessing its capabilities to take the lead in the change that applies to all stakeholders in the energy sector.

To maintain a sustainable and profitable future for the energy industry, maximising the generation of renewable energy is imperative. In the world of renewables, the majority of energy will be produced from solar and wind power and operational flexibility will be provided by storage technology, flexible gas assets using synthetic renewable fuels and optimising the life cycle of existing installations.

The pace of the change varies between different markets, but in general, everyone is speeding up. Wärtsilä has already reached the first milestone of its vision, as renewables are already competitive without subsidies in many regions. The next milestone looms ahead: renewables replacing existing inflexible thermal capacity across the globe.

"This will be the ultimate tipping point and, supported by reduced energy storage costs, will enable renewables to become the new base-load," notes **Javier Cavada**, President, Wärtsilä Energy Solutions.

WÄRTSILÄ AIMS TO BUILD OPTIMAL paths towards a renewable future by combining various assets and different technologies within power systems. The company is committed to enabling sustainable societies with smart technology and supporting its customers in the energy transition with life cycle services and solutions.



"We at Wärtsilä are helping our customers through sophisticated power system modelling that understands the opportunities provided by affordable renewable energy, and the implications it has for their power systems," says **Matti Rautkivi**, Director, Sales & Marketing, Wärtsilä Energy Solutions. "Investments in affordable renewable energy, together with flexibility, will be the winning global portfolio for our customers."

Wärtsilä's flexible power solutions offer operational flexibility, and they will be a key element in

the renewable power system. Already, Wärtsilä's engine solutions are capable of running on various gas and liquid fuels, and the company is looking for ways to develop engines for synthetic and traditional biofuels.

"We are able to support our customers throughout their asset life cycle by improving their efficiency and even contributing to new business models," says **Pierpaolo Barbone**, President, Wärtsilä Services. "We offer long-term service agreements with performance guarantees to meet our customers' business targets."

[WORDS & NUMBERS]

USEFUL DEFINITIONS AND NUMBERS OF INTEREST.

XR

X Reality, also known as Cross Reality, is a combination of digital and physical realities. It comprises a wide range of both software and hardware that allow for the creation of virtual, mixed and augmented reality content that brings together the physical and digital worlds.

OHM

The ohm is the unit of electrical resistance of a material equal to the resistance of a circuit in which the potential difference of one volt produces a current of one ampere. The name comes from German physicist Georg Simon Ohm.

150 million

The approximate distance between the Earth and the Sun is 150 million kilometres. However, as the Earth's orbit around the Sun is elliptical, the distance between the two varies throughout the year.

[TRENDS & SCENARIOS]

FUTURE PERSPECTIVES.

No more dancing with power cords

As working life becomes more and more mobile, it can sometimes be a struggle to keep all the gadgets and their related bits and bobs in one place – and when all indeed are in one place, the mess of cords can be overwhelming.

To solve this, Powertech drew inspi-



ration from Rubik's Cubes and created a combination of a power bank, wall charger and desktop charger called **Magic Cube**. Its detachable design makes it travel-friendly, and the compact design helps deal with the mess of cords in offices.

The top of the charger is detachable,

so it can serve as both a power bank and a wall charger. The bottom charger of the Cube acts as a charging dock for the top one, equipped with two AC outlets and two USB chargers for desktop devices.

Maybe not magic, but indeed modern convenience.



[CORPORATE CITIZENSHIP]

Bringing a boost to young talents

In Senegal, graduates often lack opportunities to climb up the career ladder. Wärtsilä provides local institutions with hands-on training, equipment and assistance to support students in their aspirations.

TEXT: ANNE SALOMÄKI PHOTO: 123RF

FOR SENEGALESE SOULEYMANE DIALLO, it's important to stay near his family and contribute to the wellbeing of his home country. However, after finishing his studies in information system management at Ziguinchor University, interesting job openings weren't abundant.

"Even if a student graduates with good results, there aren't a lot of opportunities available in Senegal," he explains. "Getting a job can be difficult, let alone a good one."

Through Wärtsilä's collaboration with the university, Diallo was able to secure an internship at the company's office in Dakar. It was a golden ticket: he's still working for Wärtsilä.

"I've been able to apply and practise what I've learned during my studies," Diallo says. "The internship even changed my career aspirations, and the vision I have now is very different."

WÄRTSILÄ'S PARTNERSHIPS with educational institutions in West Africa are part of the company's corporate social responsibility programme. On top of existing collaborations in Senegal, some of which include customers, there are plans to establish similar connections in Mauritania and elsewhere in the region.

According to **Salimata Dia**, communications coordinator at Wärtsilä West Africa, the main goal of these partnerships is to facilitate the progress of

young students and support unprivileged graduates to access the workforce. Another focus is on assisting communities in the areas where Wärtsilä operates.

"Our aim is to help skilled students fulfil their potential, regardless of their background, instead of having to drop out of school due to lack of access to school or funds."

SENIOR PRIVATE SECTOR SPECIALIST Lydia Murimi from Global Partnership for Education, a partnership and funding platform aiming to strengthen education systems in developing countries, sees an opportunity in company partnerships. She believes that an educated workforce is a key competitive advantage to any country, and its impact both socially and economically shouldn't be underestimated. For companies, collaboration can lead to a supply of skilled employees and a local supply chain as well as clients.

"Companies that contribute to education and act as thought leaders help build the whole ecosystem in the society."

Murimi emphasises that real engagement is more than just a "cut a check and go" approach.

"When companies and other key stakeholders take ownership and truly want to understand a country's context and challenges, everyone will benefit." ●

[COLUMN]

Strength of purpose

A QUESTION ONE IS OFTEN ASKED is, "Where do you see yourself 10 years from now?" The answer to this can vary depending on one's purpose in life. For Wärtsilä, our purpose is to enable sustainable societies with smart technology. Our purpose drives us, gives us direction and explains why we exist and how we want to make things happen now and in the future. Our purpose is an important part of our brand DNA – naturally complementing our values and powering all Wärtsiläns towards our mission.

It is a fact that over the past decade, the world has been changing faster than we can change. The rapid advance of technology coupled with our planet's shrinking resources has led to a slew of new wants and needs. We have recognised the need to embark on a new direction if we are to keep up with all these changes. That is a task that cannot be achieved by standing on one's own.

TO CHALLENGE THE STATUS QUO to lead the change towards a digitally connected, intelligent ecosystem, we must invest heavily in developing ideas to accelerate digitalisation and intelligent automation of the entire value chain.

We need to leverage data and collaborate with technology partners and startups to come up with trailblazing solutions. In this, I am happy to say, we are already succeeding. We are continuously looking for new partners to collaborate with in order to do this even better in the future.

I CAN GIVE YOU A COUPLE OF EXAMPLES of solutions that we have developed by putting our purpose into action. First, Africa's largest engine-solar PV hybrid power plant in Burkina Faso, which we created for the Essakane gold mine. This hybrid plant will enable the mine to reduce its fuel consumption by approximately six million litres per year, and also reduce its CO2 emissions by 18,500 tonnes.

The second example is on the ship the Viking Princess. In a world first, Wärtsilä installed a hybrid energy system on board the vessel, allowing it to reduce the number of power generators aboard the ship. The solution can result in 30% fuel savings and between 13% and 18% reduction in CO2 emissions per year.

Then on a smaller scale, an excellent example of providing a more sustainable world to everyone is our partnership with the Seabin project. The idea is breathtakingly innovative – a floating rubbish bin that would help keep the world's oceans clean by drawing in debris and floating garbage. This is truly an example of collaboration and out-of-the-box thinking from a company that is genuinely living up to its purpose. Wärtsilä has already donated Seabins to the Finnish cities of Helsinki, Turku and Vaasa, and just recently to Hanko and Rauma. The first Asian Seabin was installed in Singapore in April this year, and another 40 will soon be installed in other countries where Wärtsilä operates.

RITVA SEPPÄNEN
Vice President
Brand, Wärtsilä

OUR PURPOSE IS TO ENABLE SUSTAINABLE SOCIETIES WITH SMART TECHNOLOGY.



PHOTO: MARJA VÄÄNÄNEN

LATIN AMERICA: THE POWER OF ONE

United we stand, divided we fall. That seems to be the new mantra taking Latin America's energy market by storm. It is commonly believed that integrating the region's energy market will make it stronger to weather future shocks. But is it a good idea? Twentyfour7. investigates.

The energy market landscape in Latin America has changed dramatically in the past few years. Large countries like Brazil, Mexico, Chile and Argentina have restructured their energy markets as they have faced severe power deficits. Soon, they pushed aggressively for reforms, opened up their energy sectors, built renewable energy capacities to reduce their dependence on fossil fuels and made a serious effort to lower their carbon footprint.

The result is for everyone to see. Today, Latin America is amongst the world's fastest-growing renewable energy markets. According to the International Renewable Energy Agency (IRENA), the region already produces more than 200 GW or 56% of its total power from renewable sources like wind, solar and hydropower.

"Given the abundance of renewable energy sources, competitively priced renewable energy has the opportunity of replacing more polluting oil- and diesel-fired generation and providing electricity to areas not currently connected to the grid," explains **John Padilla**, Managing Director, IPE Latin America.

Despite that, Latin America is reportedly on the path to increase energy generation from fossil fuels, especially

natural gas, while modestly expanding renewable energy's contribution to 70% by 2030. An Inter-American Development Bank report says that if the region increases renewables to 80% in its energy matrix and expands cross-border connections, Latin American countries could save billions of dollars in investments, avoid blackouts and reduce their greenhouse gas emissions.

For instance, Brazil's significant wind energy potential at night could be linked with Bolivia's, Peru's and Chile's solar energy potential in the day to create a continuous supply of electricity.

ENERGY INTEGRATION

"There are some discussions concerning an integrated grid over South America. The idea is interesting but not simple to implement. Any such partnership will have to address issues related to peak services to the grid in response to instantaneous load variation and have assured short-term demand due to the intermittent renewable sources of energy," explains **Jorge Alcaide**, Regional Director, Wärtsilä Brazil.

Over the past few years there has been a serious debate on energy integration in Latin America driven by crises

TODAY, LATIN AMERICA IS
AMONGST THE WORLD'S
FASTEST-GROWING RENEWABLE
ENERGY MARKETS.

By betting on renewables, Latin American countries could save billions of dollars in investments, avoid blackouts and reduce their greenhouse gas emissions.



“THE DISTANCE FROM BOLIVIA AND PERU TO THE MAJOR COASTAL CONSUMPTION POINTS IN BRAZIL IS ABOUT 3000 KM – A VERY LONG DISTANCE FOR TRANSMISSION LINES.”

such a rising fuel prices, economic instability and incidents like El Niño*. According to a 2016 World Bank study on renewing economic integration in Latin America, “beyond the benefits from economies of scale, regional integration of electricity markets can also increase the stability of the grid by allowing countries to diversify their energy sources and achieve energy security.” But integration among such large and varied nations is easier said than done. There are cross-border pricing challenges related to energy security. Even if the region can overcome these challenges, there are technical issues to consider.

THE WEAK LINK

“While there are large interconnected networks around the world, they seldom transfer massive amounts of power from one end of the network to the other,” says Sampo Suvisaari, Regional Director, Latin America North and the Caribbean, Wärtsilä Energy Solutions. “Building sufficient transmission

capacity is very expensive, and to move energy over very long distances causes inevitable losses as well. The distance from Bolivia and Peru to the major coastal consumption points in Brazil is about 3000 km – a very long distance for transmission lines. It is usually more feasible to build closer to where energy is consumed.”

There is merit in that argument because this is not the first time the region has attempted energy integration. Take, for instance, the case of the Machala Zorritos power line between Ecuador and Peru. Inaugurated in 2004, the project reportedly remained inactive for many years on account of technical issues and inability to negotiate commercial agreements.

ADAPTING TO OPEN REGIONALISM

Despite this experience, Latin America has already begun its journey towards energy integration, albeit in small ways. According to the World Bank study, “In South America, work

is proceeding on the Andean Electric Interconnection system, a project backed by the Inter-American Development Bank (IDB), to connect the electric grids of Bolivia, Chile, Colombia, Ecuador and Peru. Countries in Mercosur** have begun to integrate electricity and energy markets, mainly through bi-national agreements and private activities. Much of the regional electric trade comes from the fact that Argentina, Brazil, Paraguay and Uruguay share several large hydroelectric dams; but there are also important natural gas pipeline connections between Bolivia and Brazil and Argentina and Chile, as well as power line connections between northern Argentina and Brazil.”

It’s not easy for most utilities players to swiftly adapt to this changing scenario. Wärtsilä is an exception.

“Flexible, fast, and efficient capacity is key for the region to succeed,” explains Alberto Fernandez, Managing Director, Wärtsilä Argentina. “On the thermal side, modelling demonstrates that only ultra-fast ramping, starting and

stopping plants are best prepared to balance the variability of renewables. Storage will play a growing role in power quality. Soon we will also be able to serve our customers with massive stored energy movement within convenient moments during the day based on demand.”

There is no doubt that technology will be an important driver going forward. Power plants will have to strike the right balance between storage, thermal energy generation and renewables that are intermittent in nature. With electricity demand in the region expected to rise more than 70% by 2030, regional integration could play an important role in increasing efficiencies and bringing down tariffs. But that is still a matter of debate. ●

* El Niño: Irregular and complex climatic changes occurring in the equatorial Pacific region

** Mercosur is a South American trade bloc comprising Argentina, Brazil, Paraguay, Uruguay and Venezuela

Argentina, Brazil, Paraguay, Uruguay and Venezuela have begun integrating electricity and energy markets through bi-national agreements.

THE KEY TO SMART MARINE INSURANCE

Eniram's partnership with insurance software provider Concirrus will enable fleet operators and insurers to 'right-size' their insurance programmes. This is a practical example of how Wärtsilä moves towards achieving its aim of a Smart Marine Ecosystem. We bring you the details.

“FOR FLEET OPERATORS, ENIRAM TECHNOLOGY FACILITATES SAFE AND EFFICIENT OPERATIONS.”

The world is moving towards a future that is more and more connected, says **Johan Backas**, Managing Director of Eniram, a Wärtsilä company.

“With increased connectivity and communication comes better visibility and transparency,” he says. “In the shipping sector we have begun this journey. The industry-wide drive towards digitalisation is already building our future evolution.”

A partnership with UK-based insurance software provider Concirrus has made it possible to create value by combining that company’s insurance data analytics with Eniram’s own operational data.

Launched in 2018, the partnership boosts the potential of SkyLight 3.0, supporting Wärtsilä’s intention to lead the marine industry’s transformation towards a Smart Marine Ecosystem via improved connectivity and the use of real-time data.

“SkyLight 3.0, delivered as a service and supplied with portable hardware, offers a cost-effective but highly accurate fuel performance-monitoring solution for vessel owners, operators or charterers who want to accurately track their fuel spend and optimise vessel operations,” says Backas.

The off-the-shelf transponder, he explains, sends vessel data over a dedicated satellite connection to the Eniram cloud.

“Eniram has created proprietary software that allows us to collect various operational data from the vessel,” he says. “The data is enriched by weather data and the ship’s operational data, for example, from the ship’s noon reports, that allow us to create additional understanding about how the vessel is performing.”

SkyLight has evolved into its latest update on the basis of customer feedback. Enhancements to the service now include mobile notifications and virtual propeller RPM (revolutions per minute) sensing.

RISK ADVICE

“In practice, our partnership is about enabling fleet operators and insurers to ‘right-size’ their insurance programmes,” says **Andrew Yeoman**, CEO of Concirrus.

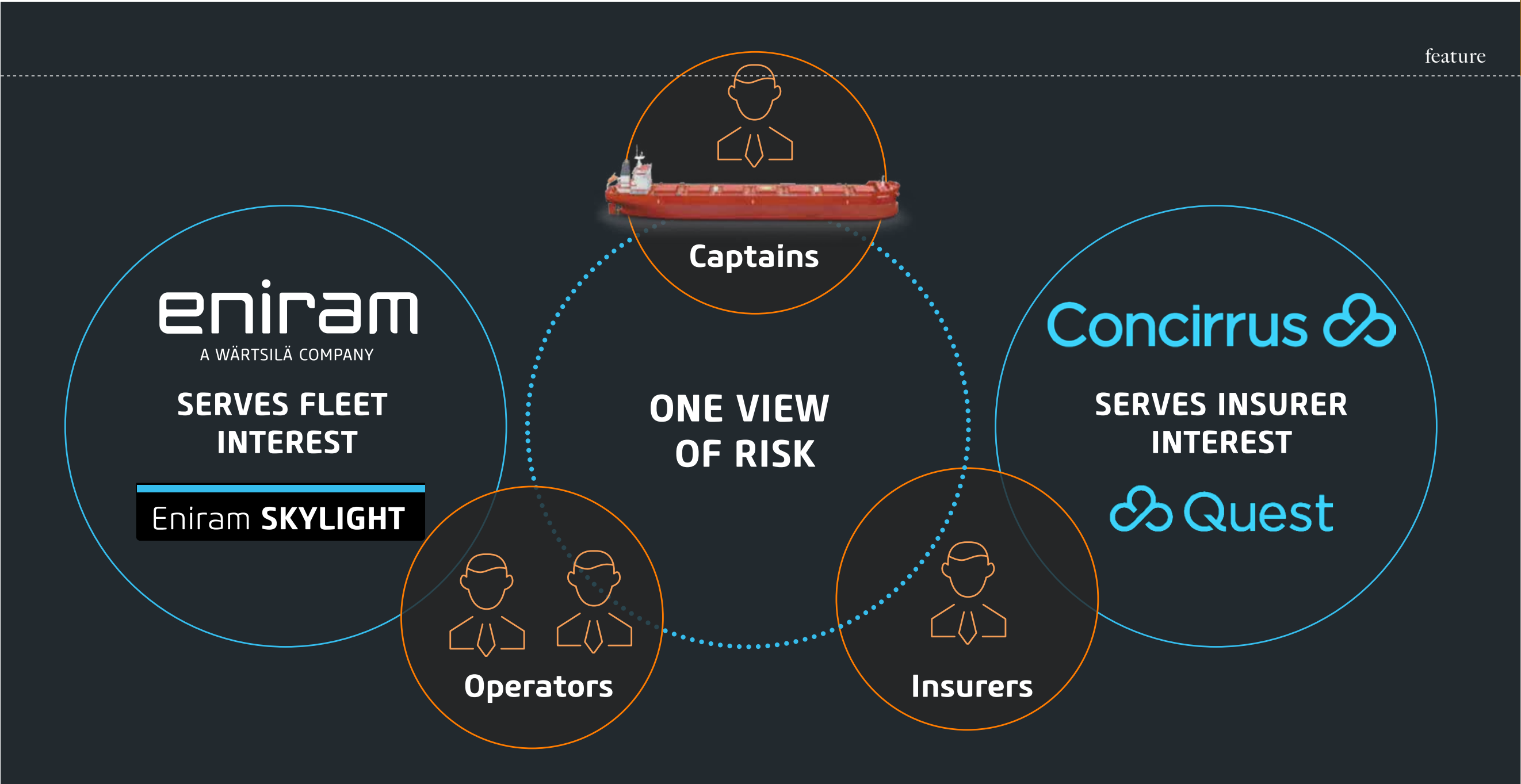
“We are entering an era of connected insurance. To take an example, a fleet operator might use their vessel in a conflict zone or their contract might cover use of a ship in the Mediterranean but not worldwide. We can make sure that the operator sticks to the terms of their agreement. Most vessels are not covered to enter all ports, and a lot of claims are registered for some ports, for groundings, for example. Through Eniram’s hardware, we can provide advice about where these risks might be higher.”

Backas adds, “Concirrus has been working in the ‘Internet of Things’ (IoT) space since 2012, helping the industry use connected data to find better profits and offer better services.”

A marine insurer had approached Concirrus to explore ways of applying their thinking in the marine insurance market, he explains. “Since the marine industry had long ago embraced technology, Concirrus recognised that there are huge amounts of data from marine operators that could be very useful for insurers. Concirrus had been using available marine movement and location data, but saw that the data from Eniram’s technology was more advanced and reliable. That’s why we have gone into partnership.”

The cooperation allows insurance companies to create connected insurance policies for their customers. By enabling real-time data transfer and analysis, digitalisation can facilitate a jump to intelligent insurance that is based on actual vessel performance.

“Both insurers and owners can view this as a win-win arrangement,” says Backas. “Accurate, real-time operational data can be used to provide a transparent and shared view of risk as well as enabling a tailored insurance cover that allows customers to pay for only what they need. Risk can be managed



proactively based on a greater understanding of the behaviour that correlates to claims. Insurers and operators can mitigate this type of behaviour before it results in claims, thus reducing risk overall.”

A DEEP UNDERSTANDING

Concirrus has a deep understanding of the insurance industry and its actors, explains Backas. “They have a very complex product that analyses marine claims data. Concirrus allows us a channel to distribute our competences into the marine insurance industry to create additional value for the insurers and consequently the ship owners, ship managers and ship operators. With Eniram’s rich history in serving marine customers, and Concirrus’ proposition for the insurance market, the partnership strengthens both offerings and accelerates market adoption.”

The opportunities presented by digitalisation will lead to a new era of collaboration and new levels of knowledge-sharing. This provides an opportunity for growth across global

value chains generally and for increasing flows of goods and services. The aim of the Smart Marine Ecosystem is to allow various actors in the maritime industry to share data.

Companies that are agile and use real-time big data analytics can react to market fluctuations far more quickly than companies that are not digitally interconnected, Backas believes. “By means of Eniram SkyLight 3.0, Eniram can understand ship operations better both in real time and with enriched data from its vast experience, also predictively. The cooperation between Eniram SkyLight 3.0 and Concirrus is a great example of connectivity.”

The insurance industry is introducing new technologies that will require better data from reliable sources. This combination of technologies helps fleet operators and marine insurers improve the reliability of vessels and lower their operational costs.

“For fleet operators, Eniram technology facilitates safe and efficient operations and has the added benefit of lowering risk,” says Backas. ●

WANTED: FUTURE TECH

As smart technology continues to conquer the world, Wärtsilä wants to be one of the pioneers in the digitalisation wave.

Technology is getting smarter by the day. With the advent of artificial intelligence (AI) and the Internet of Things (IoT), many industries are experiencing – or at least expecting – a renaissance of sorts.

According to consulting agency Gartner, companies are looking to use AI to enhance their decision making, reinvent business models and ecosystems as well as remake customer experiences. A recent Gartner survey showed that 41% of organisations have already made progress in piloting or adopting AI solutions, and the remaining 59% are still gathering information to hone their AI strategies.

At the same time, IoT keeps spreading like wildfire: Gartner estimates that there will be 21 billion connected sensors and endpoints by the year 2020. This might mean saving billions of dollars in maintenance, repair and operation (MRO).

One of the sectors facing these changes head-on is the marine industry. For example, the recent report “Smart Maritime Technology Solutions” by the Finnish Maritime Industries and Ministry of Economic Affairs and Employment observes that environmental technologies, digitalisation of shipping and intelligent ships and products are sheer necessities for growth. As automation and robotics change the production of marine solutions, the industry will pursue a “reduce, reuse and recycle” (3R) principle more and more.

DIGITAL SEAS

Professor **Pentti Kujala** from Aalto University in Helsinki, Finland, was one of the experts who contributed to the report. Kujala believes that “smart marine” means, for example, that digital tools can be brought to bear in the design and production of vessels to improve efficiency. Still, a lot of the current “buzz topics” are the result of a long evolution.

“We’ve had automation on board ships for a long time now,” Kujala says. “The new issue here is improved connectivity from land to sea, which allows remote control.”

He notes that the remote connections are not reliable at all times, but the game-changing potential is certainly there.

“When the remote control is secure, only the sky is the limit for possible applications.”

At the same time, the marine industry must stay a step – or preferably 10 steps – ahead of the pirate hackers who would gladly hijack robot ships on the high seas.

“For safety reasons, there’s an obvious need for reliable backup systems that are offline,” adds Kujala.

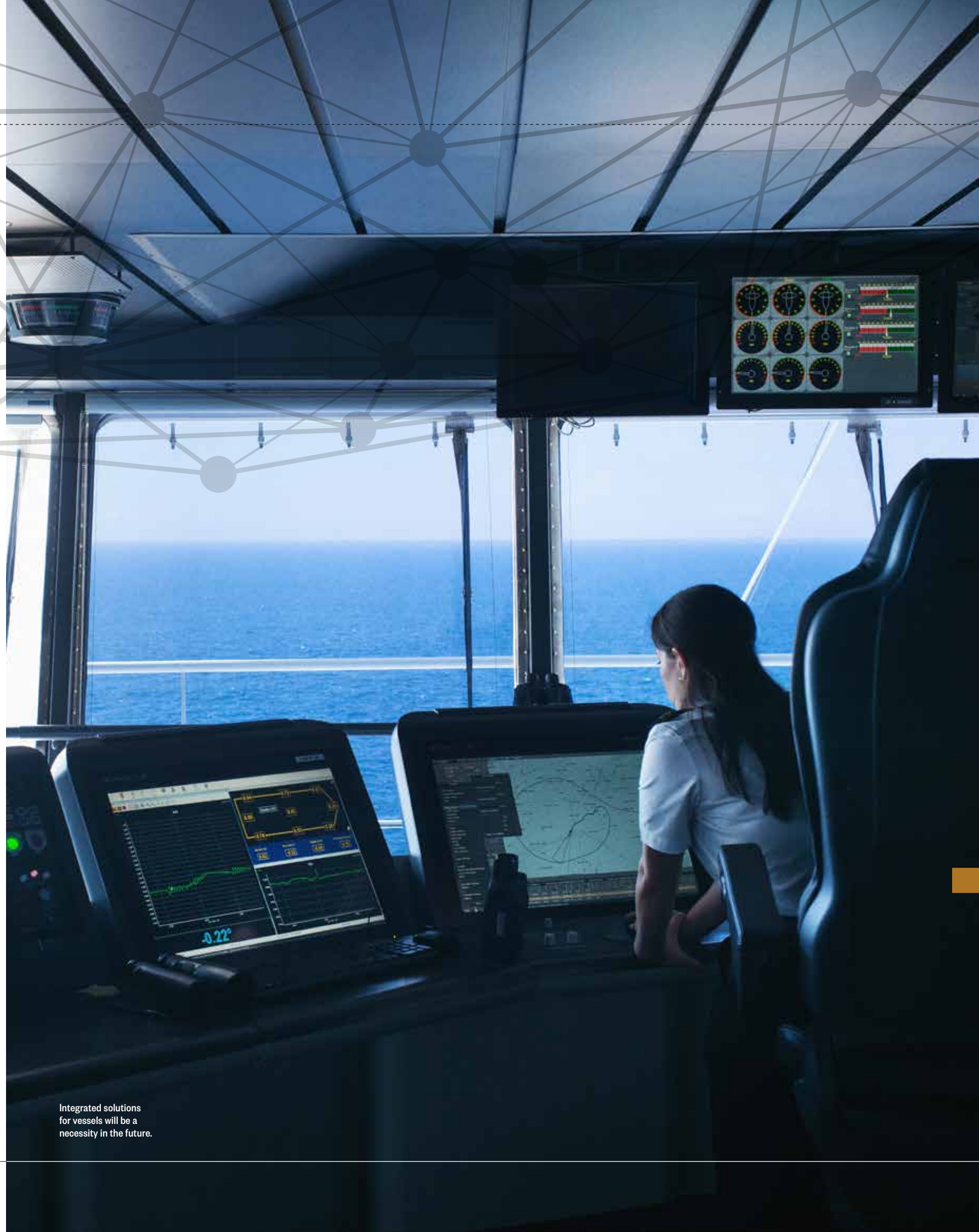
“FOR SAFETY
REASONS, THERE’S AN
OBVIOUS NEED FOR
RELIABLE BACKUP
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OFFLINE.”

CUSTOMER FIRST, CUSTOMER LAST

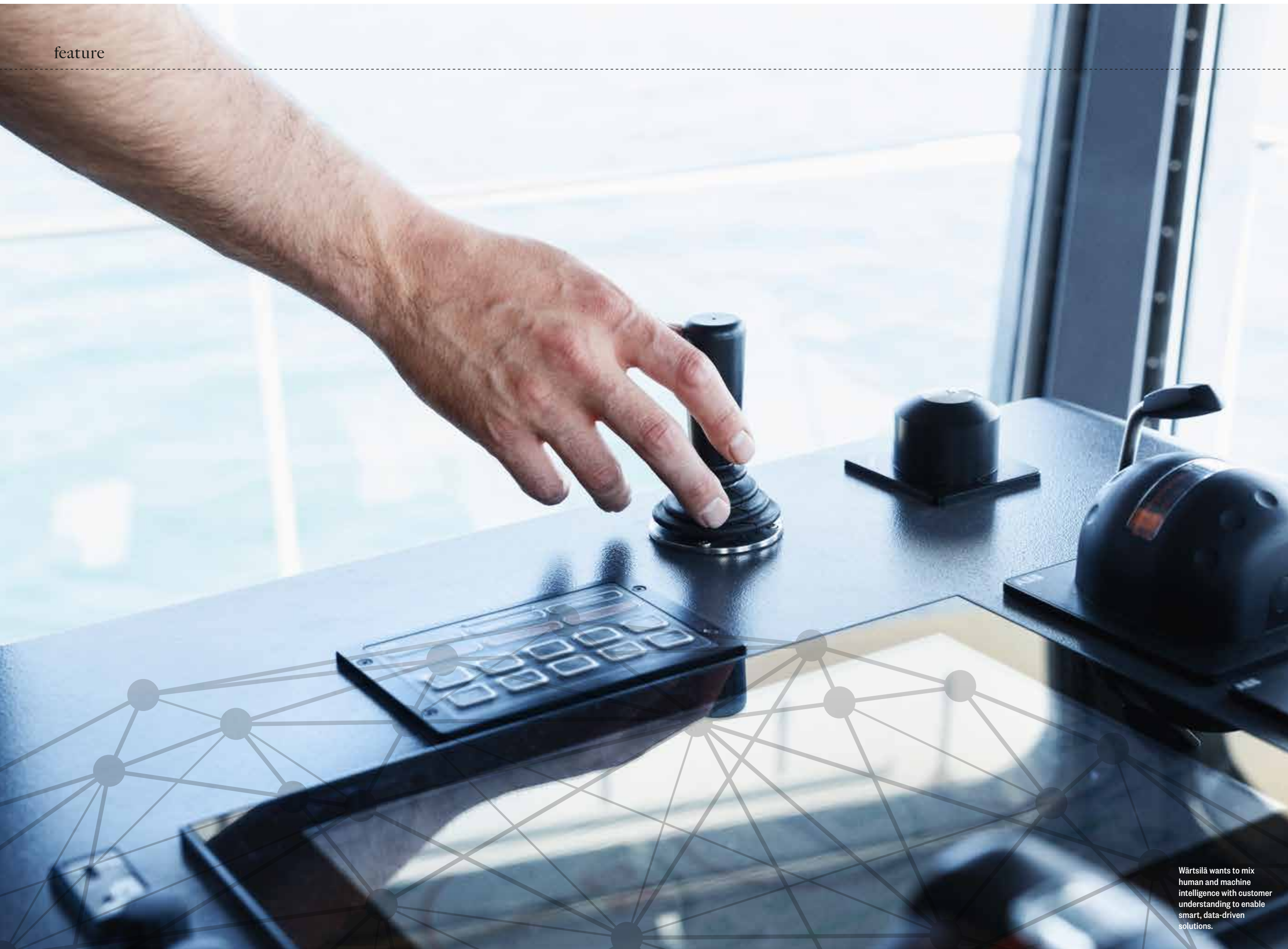
Toby White, Vice President, Digital Engineering at Wärtsilä, perceives customer value to be the driving force in the digital quest. A modern vessel has a huge variety of equipment on it, and introducing modern digital technologies on board means that there is an increasing number of value-added services available, too. According to White, the industry is basically asking customers to procure, manage and sustain an enormous amount of complexity just to go about their ordinary business – and that’s not fair.

“I believe the biggest driver towards ‘smart marine’ is going to be an overwhelming demand from customers to simplify their lives, to take away this complexity, because ultimately we are much better placed to handle it,” says White. “We at Wärtsilä are the experts on our equipment, we have a broad view of the marine market, and we are the ones who can best advise on how to efficiently operate a vessel as an integrated system.”

White observes that Wärtsilä is already seeing increasing demand in certain market segments, such as with some of the company’s cruise clients. “That trend will only accelerate, as



Integrated solutions
for vessels will be a
necessity in the future.



digital technologies continue to evolve, our digital capabilities grow, and the market matures.”

COME TOGETHER, RIGHT NOW

Looking ahead, White says there is a clear need for integrated solutions, both at the level of how those solutions are presented to customers, and also how the technologies interact.

“This will drive a huge change in how we develop and market our products, and in how our customers see value,” White says. “It will also drive a need for alignment and co-operation across the whole industry. Neither we nor our competitors can pretend that we are the only players, and our customers will be demanding that we co-operate to make their lives simpler.”

Furthermore, developments in digital technologies will also open up possibilities for products to answer customer needs that aren’t here yet. For example, White expects Augmented Reality (AR) to revolutionise certain aspects of vessel manoeuvring by providing, for example, head-up displays on bridges alerting to the presence of hazards.

“Also, common data acquisition pipelines from multiple pieces of equipment on a vessel – together with advanced analytics – will drive system-level optimisation, allowing us to treat the engine power plant and propulsion systems as a single unit.”

DIGITAL DNA

Wärtsilä wants to mix human and machine intelligence with customer understanding to enable smart data-driven solutions. White points out that AI and machine learning can, indeed, bring insight at a scale far beyond human ability, but machines still need training and their insights require analysis and context.

“Wärtsilä’s engineers have deep and abiding expertise in the design and behaviour of our equipment, and that is invaluable. We can’t build machine intelligence without that expertise, and the purpose of machine intelligence is to put more information in the hands of those experts as we deliver customer value.”

AI AND MACHINE
LEARNING CAN BRING
INSIGHT AT A SCALE
FAR BEYOND HUMAN
ABILITY.

Wärtsilä wants to mix human and machine intelligence with customer understanding to enable smart, data-driven solutions.

The maritime industry is at a crossroads of change. Stricter regulatory requirements mean that it can no longer be business-as-usual for all players. From rethinking business models to using carbon credits to changing shipping technology, the industry is doing it all. Welcome to the next era of shipping.

DISRUPTING THE MARKET, SUSTAINABLY!

The new, highly efficient, Wärtsilä Aframax tanker design.

BATTERY TECHNOLOGY WILL EVOLVE AND THE ENERGY CAPACITY WILL BE 10 TO 20 TIMES OF WHAT IT IS TODAY.

The new shuttle tanker concept creates both economic and environmental benefits for the owners.

The lines between sci-fi and reality are blurring fast for the maritime industry. Ideas like battery-powered drone-tugs that help moor vessels, artificial intelligence for ship maintenance and even relying on the sharing economy to ensure that no cargo ships are vacant are getting a push from industry leaders looking to disrupt the market, albeit sustainably.

Wärtsilä's innovation team comprising **Maarten van der Klip**, General Manager, Project Sales & Development, and **Teus van Beek**, General Manager, Ecosystem Innovation tell us how they envision this.

"Industry-wise, we see that we are moving towards a cleaner future and a cleaner society. We envision a smart marine ecosystem, with digitalisation at its heart, paving the way forward. This is what we think sustainability is all about – the same

concept, the same function but in a greener way where we reduce emissions," says van der Klip.

STRICTER REGULATIONS SET THE BAR HIGH

The most recent event that has added impetus to this global movement is an International Maritime Organization (IMO) meeting in London. The meeting, in which 170 countries participated, saw a strong push towards decarbonisation. For the first time, the global shipping industry committed to reducing emissions by 50% by 2050 as compared to 2008 levels.

"The IMO has made it clear that the industry must address emissions of methane and volatile organic compounds (VOC) from vessels. More importantly, also mentioned is that we must look at new, innovative mechanisms to reduce emissions. While shipping is the cleanest way of transporting goods and

people when compared to trucking or aviation, there's still a lot that can be done to reduce emissions further," adds van der Klip.

Marine industry leaders are already working on possible solutions.

For instance, Wärtsilä has developed various technologies from a shuttle tanker that practically eliminates emissions and uses recovered VOC as a fuel, to testing the first auto-docking system in the world.

Others, like Rightship have begun using Greenhouse Gas (GHG) ratings to measure the amount of emission let off by its vessels; all with a view to make shipping more efficient and sustainable.

"We foresee a not-so-distant future where open industry platforms will reign. Through a collaborative, joint approach

with customers, financiers, and different stakeholders we need to develop these open platforms," says van Beek.

"Battery technology will evolve and the energy capacity will be 10 to 20 times of what it is today. So, shorter sea expeditions can be run entirely on battery-powered vessels. Even block-chain will be in the picture. It can help us move towards a sharing economy where assets and information are shared between all players without middlemen. Last but not least, business models like pay per use or pay per hour will prevail and that's where we'll create lasting customer value," he notes.

In addition to developing new technology, industry experts advocate going one step further to truly decarbonise and enable sustainable innovation – by having an earning model on CO₂ – specifically through the use of carbon credits.

CARBON CREDITS TO THE RESCUE?

Since 2017, there have been over 40 countries and 25 sub-national jurisdictions that have introduced carbon pricing initiatives, either by way of taxation or through carbon credits, according to a World Bank report. Of these, 43 initiatives are based on the emission trading systems that involve trading using carbon credits as allowances.

Extending the formal emissions trading system to shipping is expected to further incentivise companies to invest in technologies that reduce emissions, by having an independent green verification.

"There exists an international voluntary CO₂ market that is expected to be worth USD 5bn. This will comprise 10% of global emissions by 2020. CO₂ reductions and pricing can be enablers for our customers and operations to become clean. While fuel reduction will remain the dominant business case driver, an additional financial incentive will be added if carbon credits are applied. Moreover, a certified carbon/fuel reduction gives high credibility and marketing value for producers who want to show that their goods are transported with low emissions," says van Beek.

There are issues that plague the current system though. Apart from issues of double-counting of credits where the same credit is resold, these credits are also most often calculated, manually, by accountants and teams leaving room for error and a lack of transparency. Going forward, experts believe that technology such as blockchain will have a huge role to play in getting the entire ecosystem on board for carbon trading.

"We need to use an open structure to make things easier for all stakeholders. Not yet another labour intensive solution, but a simple one that can be supported by open ledger or blockchain solutions. This will increase transparency by making it easier to track emission reductions and it will also maintain a permanent record of transactions," says van der Klip.

In fact, today, the chips seemed to be stacked in favour of carbon credits. Both technology as well as business leaders are coming together to create open ledger platforms to make the carbon trading process simpler across the board. With regulatory agencies like the EU also aiming to include the shipping industry under the mandate of its Emissions Trading System (ETS), it is only a matter of time before carbon credits become the new normal in tackling climate change. ●

SUSTAINABLE INVESTING IS NOT JUST PR

When it comes to the environment and social justice, more and more investors are putting their money where their mouth is – for a good reason. Read how investors really have a say in making the world a more sustainable place, and how Wärtsilä is contributing to the change.

Ideology and high profits haven't traditionally been seen as things that go hand in hand. However, the way investors act on sustainability has changed significantly in the past decade.

"10 or 15 years ago, the environment was mainly a concern for insurance companies, in the sense that climate change increased the risk of natural disasters," says Deputy Managing Director **Esko Kivisaari** from Finance Finland, an organisation representing the financial sector in Finland. "It wasn't something that was of importance to a lot of investors."

Since then, plenty has happened and people, including investors, have grown more and more aware of the environmental effects of their actions. Ethical and environmental issues are not just a topic on the PR team's table, according to Kivisaari; they have risen all the way to senior management teams and boards of directors. In organisations, everyone talks about ESG, meaning environmental, social and governance, a term used to measure the impact of a company or a business.

At Wärtsilä, ESG is incorporated in everything from research and development to employer responsibility.

"The technologies and services we develop help our customers reduce their ecological footprint and support sustainable development in the marine and energy industries," explains **Natalia Valtasaari**, Director, Investor and Media Relations at Wärtsilä. "We also take our role as a socially responsible employer very seriously, ensuring safe working environments, equal opportunities and fair employment practices to all staff across Wärtsilä locations."

SUSTAINABILITY MAKES BUSINESS SENSE

Socially responsible investing seeks to sum up the financial return and social and environmental impact that brings about positive outcomes. On top of environmental issues, the term responsibility comprises things such as human rights, diversity and health effects. Some investors might avoid the arms industry or fast food.

Investing to advance social change is not a new phenomenon, however. For instance, in the 1980s, a disinvestment campaign was deemed to contribute to the pressuring of the South African government to do away with the apartheid system.

Recent examples are abundant. Earlier this year, Reuters reported that a Norwegian health fund is creating standards regarding saltwater resources for companies it invests in. Global investment management corporation BlackRock decided to take a careful look at the manufacturers and retailers of civilian firearms in its portfolios in the wake of the Florida shooting.

However, Kivisaari points out that these days investing in sustainable options isn't only a choice made by the most conscious of us – it often just makes business sense.

"Being 'green' is no longer just a way to build a company brand," he says. "Investors see it as an important factor when they evaluate the long-term profit prospects of their shares."

"BEING 'GREEN' IS NO LONGER JUST A WAY TO BUILD A COMPANY BRAND."

PROMOTING A LOW-EMISSIONS ECONOMY

The profitability partially stems from the fact that sustainability is also a globally acknowledged objective, stated by the United Nations' Sustainable Development Goals. Wärtsilä's Valtasaari sees the goals as an excellent way to motivate companies to take action, and simultaneously they encourage investors to make ethical decisions.

"Many investors are already very well aware of new environmental standards," she tells. "As the energy markets transition to renewables and the marine industry seeks to reduce emissions, the market potential for Wärtsilä's solutions increases."

Valtasaari says that Wärtsilä has already developed, and continues developing, products and services that offer greater flexibility and efficiency as well as opportunities for optimised energy production and usage. This, alongside renewable energy integration, provides Wärtsilä and its customers ways to comply with the rising standards and ambitious climate goals set

by not only the UN, but also the EU, industries and individual companies.

IN IT FOR THE LONG HAUL

Both Kivisaari and Valtasaari believe that sustainable investing will only keep on growing, as changing policies and principles increase the attractiveness of sustainable portfolios.

"Old industries might offer higher annual returns right now, but as attitudes and mindsets change, their value might drop drastically," says Kivisaari. "From a risk management perspective, it's likely to be more sensible to settle for lower instant profits but expect them to rise over time."

Valtasaari emphasises that a sustainable society can't be built in a day, but that shouldn't deter anyone from contributing to it. "Companies with solid sustainability strategies now will be in a strong position in the future, including financially," she says. "In the future, ESG will not only be a crucial part of all company processes but also integral to investment decisions." ●

TEXT: PAYAL BHATTAR PHOTO: ISTOCK

in-depth

A power cut is one of the worst nightmares come true for electricity consumers, industries and economies. It brings life to a grinding halt and impacts productivity across the board. Is there a way out of the darkness?

BLACKOUT ECONOMICS

ANALYSES FROM
BLACKOUT EVENTS IN THE
US SHOW THAT A
30-MINUTE POWER CUT
RESULTS IN AN AVERAGE
LOSS OF EUR 13,500 FOR
MEDIUM AND LARGE
INDUSTRIAL CLIENTS.

In December 2017, the world’s largest airport, the Hartsfield-Jackson Atlanta International Airport, faced a partial shutdown on account of a power outage. The outage left thousands of passengers stranded for almost 11 hours and led to the cancellation of several flights. A few days later, us airline company Delta stated that it had lost between USD 25–50 million in revenue due to the incident and wanted its losses to be compensated.

Delta was only one of the many airline operators that had to cancel flights that day. The cumulative impact to business would have been multi-fold. That’s the destructive power of just one power cut in an energy-efficient economy.

According to a report by Allianz, “The financial impacts of even a small power cut can be catastrophic. Analyses from blackout events in the us show that a 30-minute power cut results in an average loss of EUR 13,500 for medium and large industrial clients, and nearly EUR 81,000 for an eight-hour interruption. Even short blackouts – which occur several times a year in the us – add up to an annual estimated economic loss of between USD 104 and USD 164 billion.”

The report also states that a single historic power blackout has typically resulted in a loss of 6,000,000 euros per hour for the financial trading sector and 30,000 euros per minute for the telecom sector.

WEAK LINK

The results of rolling power cuts can be far more devastating and long-term in nature and bring an entire economy to a grinding halt. Take for instance the case of South Africa. Between 2008 and 2015 the country lost billions on account of rolling blackouts caused by poor system planning and weak



Between 2008 and 2015, South Africa lost billions on account of rolling blackouts caused by poor system planning and weak policy decisions.

SMART POWER GENERATION HELPS UTILITIES ACHIEVE SIGNIFICANT FUEL SAVINGS.

policy decisions that dated back to 1998. The country delayed building large-scale coal-fired power plants and was faced with a massive supply gap.

Alternatives, such as refurbished old and inefficient coal stations and diesel-fuelled open cycle gas turbines (OCGTs), set the tariff skyrocketing because they were expensive to operate on account of low efficiency and high fuel costs.

“In South Africa, it is estimated that the cost of unserved energy is approximately 100 times the actual cost of electricity. It is a classic example of why large-scale power plants that take many years to build are inappropriate in a world where change is constant and disruption is around every corner,” explains **Wayne Glossop**, Business Development Manager, Wärtsilä Energy Solutions.

BETTING ON SMART SOLUTIONS

South Africa’s solution could be found in adopting decentralised Smart Power Generation systems, which use a combination of renewables, gas and storage. Currently, the recommended energy plan for South Africa indicates a clear transition towards a heavy gas/renewable (not storage, yet) energy

mix up until 2050, but implementation of this recommendation is yet to materialise.

Smart Power Generation helps utilities achieve significant fuel savings not only during times of a power crisis but also in daily grid operations and provide consumers reliable and cost-effective electricity. Several economies around the world are now opening up to Smart Power Generation to overcome the deficit in their legacy power systems.

Sampo Suvisaari, Regional Director, Latin America North and the Caribbean, Wärtsilä Energy Solutions, explains, “Power outages and blackouts are nearly always related to either distribution or transmission system failures rather than power generation capacity per se, or as was the case in a major power outage in Puerto Rico in 2016, it was due to old-fashioned centralisation of power generation in unit sizes that are too large. Through Smart Power Generation, electric systems can become cleaner, more efficient and more reliable.”

Indeed. The good news is that the cost of renewables as well as storage systems have been falling. That makes it not just a smart but economically and financially viable solution that will help reshape the global utilities sector going forward. ●

COST ANALYSIS OF HISTORIC BLACKOUT SCENARIOS

Industry financial loss	per event
Semiconductor production	€ 3,800,000
Financial trading	€ 6,000,000 per hour
Computer center	€ 750,000
Telecommunications	€ 30,000 per minute
Steel works	€ 350,000
Glass industry	€ 250,000

LOOK, MA, NO HANDS!

You don't have to be a salty and crusty sea captain to fathom how delicate and sensitive docking a ship can be. The combination of auto-docking and wireless charging on a ferry, a world first, could make things a lot simpler.

Fluttering winds and eddying currents can throw off even the most experienced helmsman. It is no surprise then that some of the latest developments in dynamic positioning – keeping a crane ship still in the high seas, for example – and autonomous driving technology have evolved together to allow a ship to automatically dock in a harbour. The docking manoeuvre is probably one of the most precarious operations a ship can undertake.

In the small world of auto-docking, Wärtsilä Marine Solutions and its Dynamic Positioning Inc. (DP) subsidiary in San Diego, California, is leading the pack, and making waves, so to speak.

Their prototype auto-docking system was successfully tested on the Norwegian RoRo passenger ship Folgefonn, first out in the open water on a simulated dock in January 2018, and then again successfully in the Stord harbour in Norway in April 2018.

“We’ve translated our offshore DP expertise into a new and exciting potential market – ferries and maybe cruise ships. It fits very well into Wärtsilä’s overall ‘smart marine’ strategy,” says **Thomas Pedersen**, Managing Director of Wärtsilä DP. “The plan is to submit the auto-docking functionality for regulatory approval to make automated docking a vital part of new offerings for the ferry and other markets.”

Auto-docking simply means a ship is programmed with all the variables of its approach to a dock – wind speed, weight, pitch, roll, current, depth and so on – to perform the manoeuvre automatically in the most efficient and safest way possible, within oversight of a captain, of course, but steered principally by software. By making docking as efficient and sustainable as possible, fuel expenses are also minimised.

AN INNOVATIVE SHIP

The Folgefonn is a novel ship even without auto-docking. A double-ended, 85-metre-long, 1182-tonne hybrid-powered passenger and car ferry servicing Jektevik-Hodnanes, Norway, the Folgefonn carries 76 cars and 300 passengers. It is owned by Norled,

which operates 45 car ferries across Norway, and was built as a diesel-powered ferry in 1998. It was retrofitted into a hybrid diesel/electric vessel in 2014 with the help of Wärtsilä’s wireless inductive charging technology, both on land and aboard, allowing it to charge its batteries without cumbersome cables. Folgefonn is also using vacuum docking technology (Cavotec) where suction keeps the ship at the dock, eliminating ropes or lines.

Part of the auto-docking research performed by Wärtsilä is also being funded by the Norwegian maritime authorities.

“Wärtsilä Norway and Norled have both received grants from Innovation Norway, an investment fund, to test auto-docking and integrate it with the existing hybrid energy system,” says **Ingve Sørforonn**, Senior Technical Officer E&A, Wärtsilä Marine Solutions. “For many years, the Power Conversion organisation in Stord, Norway, has worked with the Folgefonn ferry on numerous innovations including electrical operation, land-based charging, data transfer and induction charging. With auto-docking, the total docking and charging sequence will now be automated.”

A NATURAL EVOLUTION

Pedersen adds, “The Folgefonn was already equipped with our inductive charging technology and the owners were very receptive to auto-docking. These efforts are part of the industry’s overall desire to automate more of a vessel’s movement.”

Extensive testing of the system was key to making the ship’s environmental sensors interface with software to precisely control the ship’s propulsion systems. This work – sequencing and calibrating thrusters, for example, and developing a user interface – is what makes Wärtsilä Dynamic Positioning a leader in the field.

“We finished the Folgefonn tests and gained much valuable test data, plus more general experience, which was useful for updating our overall auto-docking methodology,” says Pedersen.

In both tests, the Folgefonn ship was taken off its



research and development

Auto-docking is one of the first steps in fully autonomous shipping.

AUTO-DOCKING AND OTHER AUTOMATED FUNCTIONS ARE A PART OF WÄRTSILÄ'S MUCH WIDER SMART MARINE ECOSYSTEM STRATEGY.

regular ferry service during planned repairs and made available to Wärtsilä DP engineers.

SMART MARINE ECOSYSTEM

Auto-docking and other automated functions are a part of Wärtsilä's much wider Smart Marine Ecosystem strategy, unveiled in November 2017, which will focus on “intelligent vessels and smart ports”, among other initiatives.

“The world is moving towards a future that is more and more connected, and nowhere is this more apparent than in the shipping sector. The opportunities offered through smart

technology will foster a new era of collaboration and knowledge sharing with customers, suppliers and partners,” says **Roger Holm**, President, Wärtsilä Marine Solutions.

Andrea Morgante, Head of Digital, Wärtsilä Marine Solutions adds: “At Wärtsilä, we are fully engaged in developing ‘intelligent’ vessels since we consider such technologies to be vital to maintaining a profitable future for our customers.”

Says Pedersen in conclusion: “Auto-docking is just a new application built on the dynamic positioning capabilities we have had over many years. It is one of the first steps in fully autonomous shipping.” ●

Makeover time for *the shipping industry*

Frank Coles is a provocateur.
But unlike many noise makers,
he knows what he is talking about.



“I DO LIKE TO
CHURN THINGS UP.
AND I WON’T BE
SILENT!”

Frank Coles is the CEO of Transas, a UK-based company acquired by Wärtsilä in May 2018. With 1000 employees, Transas is a global leader in marine navigation solutions that include complete bridge systems, digital products, electronic charts and vessel tracking equipment for traffic separation schemes.

For Wärtsilä Marine Solutions, the EUR 210 million acquisition brings vital expertise in solidifying the company’s Smart Marine Ecosystem vision with 21st century products and platforms.

Coles has spent his career in the maritime sector in various global functions and is no doubt the man for the job.

FOOD FOR THOUGHT

“The business of maritime operations is FOSSIL: Fleet Operations Solutions Stuck in Limbo. We are in a limbo because we add technology while navigating with paper,” said Coles during a keynote address at the Transas Global Conference 2018 in Vancouver, Canada, which could double up as a TED-style talk.

“Maritime operations and infrastructure thinking seem to change at a snail’s pace. We seem to be content to have old-fashioned ships and an old-fashioned business infrastructure sitting alongside modern logistics,” he continues.

In very broad terms, most people know how the maritime industry remains a traditional tonnage-based industry racing to stay afloat in a sea change of new technologies.

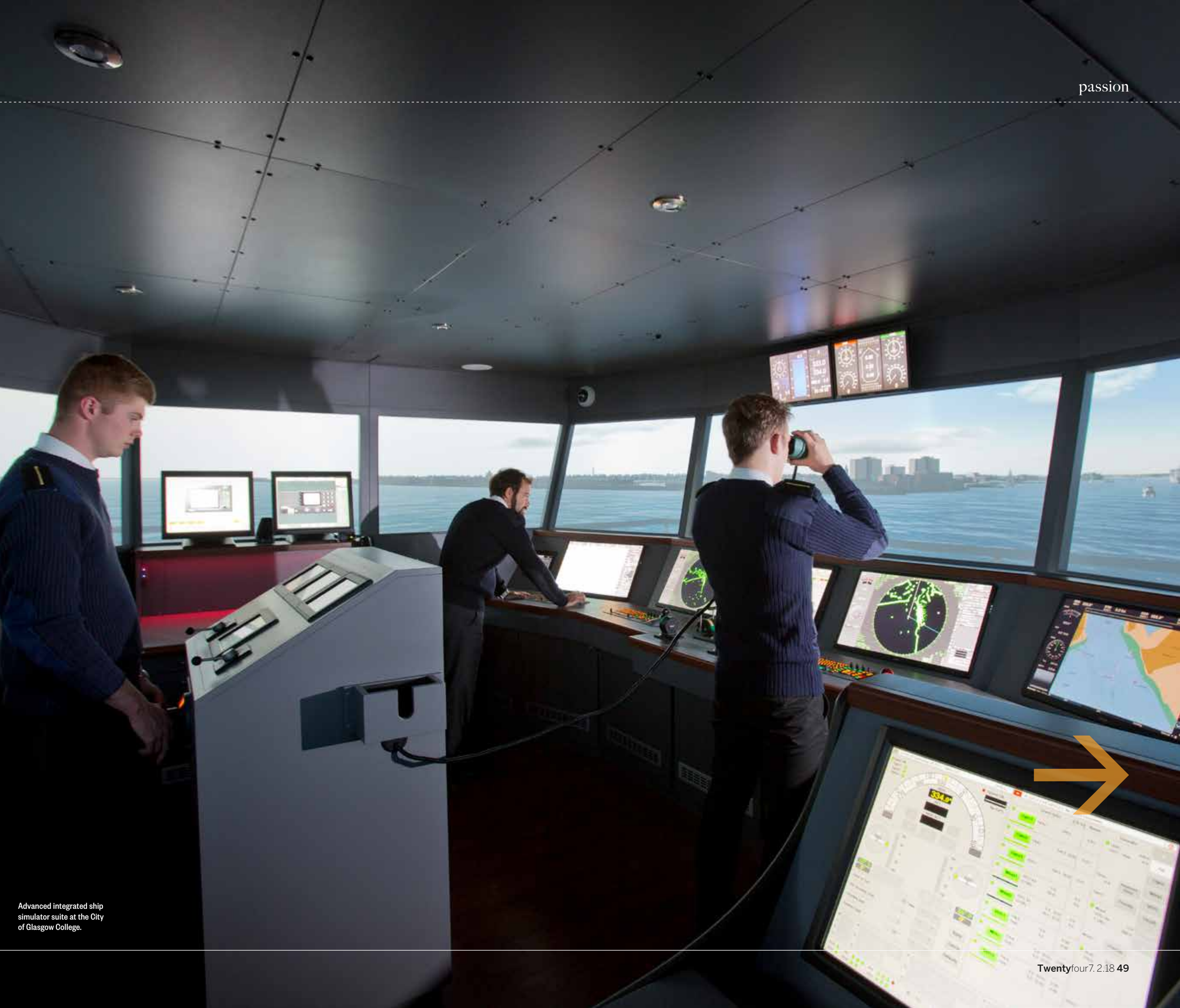
“I do like to churn things up,” Cole says. “And I won’t be silent! The problem with this above scenario is that the maritime industry is just not keeping up, with the logistics. The pace of change in logistics far exceeds that seen in maritime operations.”

Coles will continue as Transas CEO in the fold of Wärtsilä, and help in this process of finding efficiencies in the business.

MASTER AND COMMANDER

Coles was born in 1959 in Zimbabwe to British parents with a maritime background and sailed for 12 years in the UK’s merchant navy, gaining a master’s certificate in the process. It soon became time to continue his career onshore, which led to a law degree from the University of Wales, Cardiff, in the UK. With time at sea and by then a full-fledged lawyer, a young Coles went on to become the very hands-on Operations Director for Pacific Basin Bulk Shipping in Hong Kong running a fleet of 50 bulk carriers around the world.

The time at Pacific Basin in the early 1990s coincided with the advent of ship-to-shore email and other electronic communications and Coles moved to Globe Wireless, a specialist in ship-to-shore wireless communications applications. He was



Advanced integrated ship simulator suite at the City of Glasgow College.



CSMART Academy, Carnival Corporation – one of the most advanced maritime simulation and training centres powered by Transas technology.

“WE NEED TO BUILD SHIPS WITH INTEGRATED SYSTEMS AND NOT A MISHMASH OF STAND-ALONE IOT.”

recruited to the Transas CEO position in 2015 to whip the company into shape for a possible merger or sale.

“Transas is very good at what it does,” says Coles. “But with the direction the maritime industry is now taking, consolidation is required to take the business to the next level. I’ve been fortunate to be in this industry for over 40 years and even run a shipping company. So this merger with Wärtsilä is what I myself would have wanted.”

A DONKEY OR A RACEHORSE?

There is a lot of energy, enthusiasm and thinking out of the box in Coles’ entrepreneurial and organisational spirit.

“For the longest time, efficiencies in shipping only came from moving larger volumes with bigger ships and the environment be damned,” Coles says. “That is how this penny-pinching industry has been structured from the very beginning. We layer modern technology on top of old-fashioned business processes. The old-fashioned structures of regulators, clubs, lobbies and representative bodies no longer fit with the new world. Nor do they move fast enough to keep up. We cannot keep designing a donkey when we are looking for a racehorse. It is going to bite us in the ass (Archaic Spaghetti Structure). We need to build ships with integrated systems and not a mishmash of stand-alone IoT applications.”

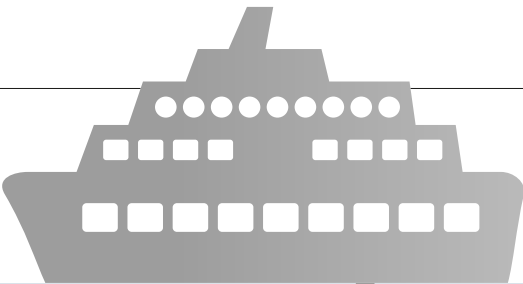
While the acquisition of Transas by Wärtsilä provides the digital platform and scale, Coles is advocating for step-by-step modernisation of the industry into a smart marine ecosystem that will also help attract younger people to careers in the industry. “Young people want safe and environmentally safe workplaces and efficiencies on the scale of Amazons or Alibabas. Black smoke is no longer acceptable,” says Coles.

For Wärtsilä, Transas will help connect bridge systems, condition-based monitoring, power generation and other dynamic technologies with the Transas portfolio of ship traffic control, simulators and e-navigation solutions.

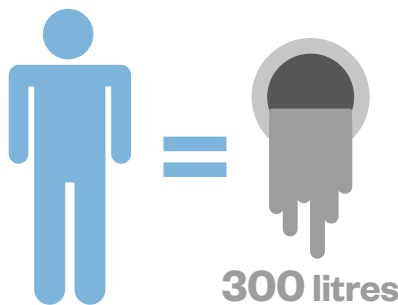
“It is incredibly exciting to have this opportunity to join the Wärtsilä brand in delivering the future of maritime transport,” Coles says. “We share a common vision, one of a safer, more efficient and more environmentally friendly maritime industry. The Transas team has significant competences in technology, along with a globally recognised leadership position in navigation, simulation and traffic control systems. Adding these to the extensive, world-leading Wärtsilä portfolio of services and products provides an unparalleled opportunity for a new ecosystem for maritime operations. If anyone can do it, Wärtsilä can.” ●

FROM WASTE TO WATER

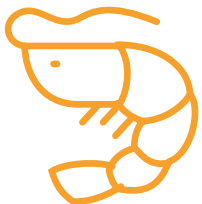
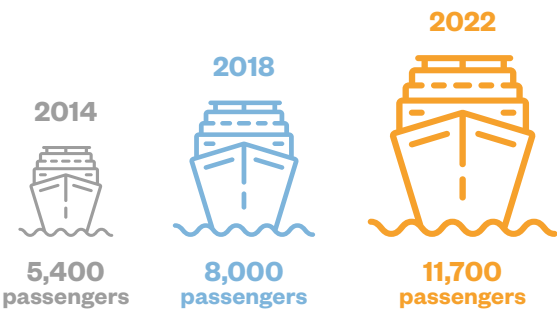
A CRUISE-SHIP PASSENGER CAN GENERATE UP TO 300 LITRES OF WASTEWATER A DAY, CONTAINING MANY SUBSTANCES THAT ARE NOT ENVIRONMENTALLY FRIENDLY. IN THE INTEREST OF ALL THINGS GREEN AND CLEAN, SHIP OPERATORS ARE UPPING THEIR GAME, BUT IT IS NOT AS EASY AS IT SOUNDS. WE TELL YOU WHY.



REALITY



CRUISE SHIPS ARE GETTING LARGER



MARINE LIFE IS IN DANGER

- Fats, oils, chemicals, bleaches and germs make a dangerous cocktail polluting the water.
- Black-water (essentially sewage) reduces oxygen in the water and damages shellfish.



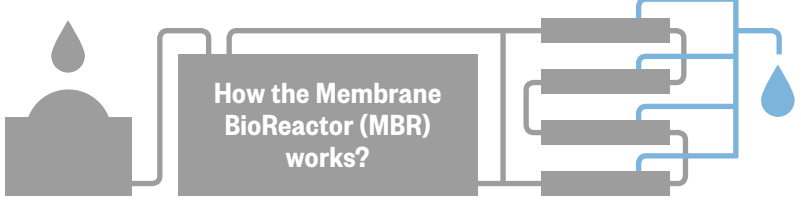
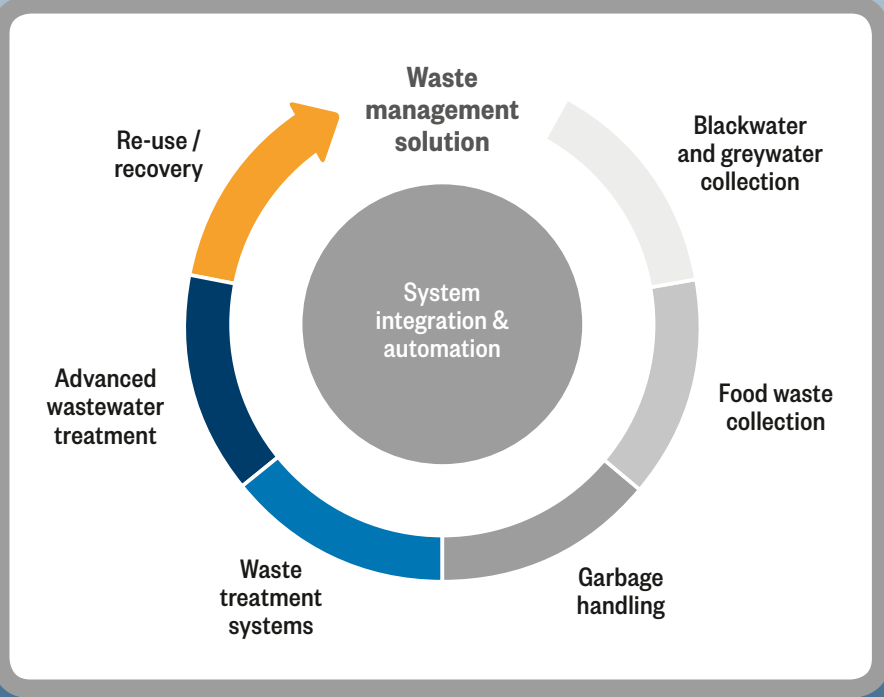
SHIPS ARE GOING FURTHER

Ships are going to new and environmentally-fragile places, such as the polar regions and the Amazon.

PROBLEM

- Wastewater management rules vary from region to region.
- No one inspects how a ship's Type Approved wastewater treatment plant on board is operating during its lifetime.
- Some older ships are too small for retrofits to the latest wastewater management systems.

SOLUTION



THE BIOREACTOR

- Wastewater is put through the fine, automatic pre-screen into the bioreactor.
- Inside, active biomass degrades organic material.

ULTRAFILTRATION MEMBRANE MODULES

- Biomass is circulated through ultrafiltration membrane modules to produce a trans-membrane pressure and scouring velocity.
- Clean permeate is drawn from the membrane modules.
- Continuous improvements in membrane flux rates now allow up to a 50% decrease in power requirement since 2010 designs.

TEXT: ISABELLE KLIGER PHOTO: TRIDENT

solution

With the acquisition of the Dutch underwater solutions specialist Trident BV, Wärtsilä will now be able to perform maintenance and repair services underwater, providing a better service portfolio for our customers, resulting in minimal downtime – and enabling operators to avoid the potential loss of income of having to bring a vessel into dry dock.

SAVE TIME WITH UNDERWATER REPAIR AND MAINTENANCE



“NO VESSEL WILL EVER
BE FAR FROM ONE
OF OUR SPECIALIST
UNDERWATER TEAMS,
SHOULD A SITUATION ARISE
THAT REQUIRES THEIR
ASSISTANCE.”

The acquisition of Trident will enable Wärtsilä to become the first original equipment manufacturer with a global underwater services footprint. Trident's offering includes underwater repair, overhaul of propulsion systems, and regular maintenance such as hull cleaning and propeller polishing. It also carries out wet welding repairs, providing an equivalent level of quality to what would be delivered in a dry environment and certified by the major classification societies, as well as cofferdam repair, which allows for permanent shell plate repairs while afloat. Trident is known for executing fast, reliable and complex repairs underwater.

Trident was established in 1993 when commercial diver **Adrie Huijbregts** took the plunge and set up his own underwater repair and maintenance firm. Since then, the company has gone from strength to strength, creating an unrivalled reputation as the number one provider of highly skilled underwater services. As a result of its excellent track record, Trident's repairs are typically covered by the warranty of the OEMs with which it partners.

TOTAL, GLOBAL SERVICE AND MAINTENANCE

Fast-forward to 2018 and Trident has been acquired by Wärtsilä. Together, the two companies will be uniquely positioned to offer marine service and maintenance, wherever and whenever it is needed, regardless of whether a vessel is on land or at sea.

“Trident will add another string to Wärtsilä's bow.

Going forward, we will work closely with engineering colleagues in Wärtsilä to support them in product design to allow for easy underwater maintenance,” says Huijbregts, who will remain with Trident under the Wärtsilä umbrella in an advisory role.

Over the past decade, Trident has created an internal, innovative brain trust as a means to transform ideas into reality.

It has resulted in new industry standards for servicing propulsion equipment below the waterline. An example is the award winning FLEX-DAM hyperbaric habitat for shaft seal replacement on main propulsion shaft lines.

Trident serves customers around the world by using its fully equipped workshops and certified personnel in the Netherlands, Italy and the Canary Islands. Going forward, its state-of-the-art equipment and expertise will be combined with Wärtsilä's global presence.

“No vessel will ever be far from one of our specialist underwater teams, should a situation arise that requires their assistance,” says Trident's Managing Director, **William Winters**.

COMPLEX UNDERWATER OPERATIONS

Trident's offering extends far beyond standard underwater cleaning and maintenance services. In November last year, it carried out a full underwater exchange of a stabiliser fin weighing more than 20 tonnes on behalf of the cruise company AIDA Cruises.



TRIDENT IS KNOWN
FOR EXECUTING FAST,
RELIABLE AND COMPLEX
REPAIRS UNDERWATER.

“This was the first time that a stabiliser fin had been exchanged without taking the vessel out of service,” explains Winters. “The alternative would have been to take the ship to dry dock and lose the income for the cruise, or to wait for the next scheduled dry docking, which was several years down the line.”

In another recent case, Trident removed and reinstalled a rudder weighing 30 tonnes on a fully loaded bulk carrier in Stavanger, Norway.

“Operations such as these are not inexpensive, but when a vessel operator has to take its ship out of service and put it in dry dock due to an unplanned stoppage, the potential loss of income is astronomical,” continues Winters. “Now that we know we can carry out complex overhauls underwater, it will change the nature of vessel repairs and maintenance.”

CLEAN HULL FOR ENHANCED FUEL EFFICIENCY

Going forward, there are further plans to integrate Trident’s services with the cutting-edge innovations from

Wärtsilä’s digital portfolio. For example, the combination of its hull-cleaning services with Eniram’s analytics will allow for maximum fuel savings through optimised hull cleaning cycles.

“A clean, friction-free hull is key to maximising the fuel efficiency of a vessel as she glides through the water. With Eniram’s sensors, the vessel will tell us when its hull needs cleaning, allowing us to carry out the service at the most opportune moment, without disrupting the operation of the ship,” explains Huijbregts.

Last but not the least, Trident is also in the process of developing an environmentally sound method for underwater hull cleaning. The new process will make it possible to remove fouling from the ship’s hull and safely bring it up to the surface, after which a filtering process allows the water back into the environment without releasing any contamination. This sustainable hull cleaning service will be the first of its kind in the market and, unlike other available solutions, can cover close to 100% of the submerged hull. ●



**LNG IS COMING TO
A TERMINAL NEAR YOU**
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**THERE’S A NEW SHIP
ON THE HORIZON**
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Twentyfour7.
in detail

LNG IS COMING TO A TERMINAL NEAR YOU

► TEXT: ALEXANDER FARNSWORTH PHOTO: WÄRTSILÄ

THERE IS A quiet revolution going on and it is spot on. The revolution in question concerns the commoditisation of LNG and how a dramatic market shift is affecting the procurement of LNG, especially in northern Europe.

Commoditisation is what happens when an exclusive product becomes, over time, desirable and affordable to many – where distribution networks are built to accommodate smaller parcels of a product as they are made available to more and more people.

Traditionally, LNG has been an option only for customers that can accept a full cargo from huge ships that transport it across the oceans. Projects were built on long-term contracts, up to 20 years, with customers for large volumes of LNG. With the surge of shale gas production in the US, LNG is flowing into the market to the tune of an annual capacity of 50 million tonnes by 2020, as reported by Reuters in March 2018. The flexibility offered by US producers has accelerated the development of more mature LNG markets.

DEVELOPING A SPOT MARKET

According to **John Reinlund**, Strategy and Business Development, LNG Solutions at Wärtsilä, who follows these developments closely, the LNG landscape is evolving.

“LNG is going through a similar commoditisation process as the oil markets did during the previous century. LNG buyers are signing shorter and smaller contracts and the customer group is becoming more diverse,” says Reinlund.

“The share of spot deliveries, for example, single cargoes for delivery in the near future, has been growing and is now about 25%, which reflects the fact that the market is evolving. The LNG market is still illiquid compared to oil, with traders only recently grabbing more of the market. However, LNG is on a path to becoming a commodity. This includes increasing flexibility in small- and mid-scale LNG. Trucking of LNG is already quite common,” he explains.

For small and mid-scale projects, it is not economically feasible to transport LNG long distances. Additionally, there haven’t been many liquefaction plants and LNG terminals that could, or would, accept small-scale vessels. The normal in this scale of operations has been to have only one or a few potential suppliers.

“The result of all this is that we are starting to see a spot market for small-scale LNG deliveries developing.

“LNG IS GOING THROUGH A SIMILAR COMMODITISATION PROCESS AS THE OIL MARKETS DID DURING THE PREVIOUS CENTURY.”

In Northern Europe, small-scale LNG has reached a critical mass thanks to the International Maritime Organization’s emission rules and investment support from the European Union. Additionally, owners have had the foresight to design the infrastructure with the right kind of flexibility. Large-scale terminals are starting to see economic potential in investing in break-bulking capabilities to supply LNG in smaller lots for regional distribution,” says Reinlund.

EXPANSION OF GAS

Some examples include GATE in the Netherlands, Zeebrugge in Belgium, and the floating storage and regasification unit (FSRU) in Lithuania that are competing for a place in the market with the large-scale

terminals in Poland, the UK, and France in the second wave. Liquefaction plants that are capable of loading small-scale vessels already exist in Norway and will soon in Russia. Additionally, the small-scale terminals on the Finnish and Swedish coastline have either been designed for, or are contemplating, reloading capabilities. All of this creates flexibility in the system. Another enabling factor is the availability of small-scale LNG carriers and bunkering vessels that offer excess capacity.

“Maybe we can’t call it a fully functioning small-scale LNG spot market according to a trader’s definition, but the fact that there are enough suppliers on the market for customers to choose from has made it possible to purchase single cargoes. For small- and

mid-scale projects, strict Take-Or-Pay clauses in the LNG contracts can be problematic, but now you can make up the balance with spot cargoes, just as in the large-scale world,” says Reinlund.

When asked where this could happen next, Reinlund says, “The western Mediterranean already has all the ingredients on the supply side, but there are fewer small- and mid-scale customers in that region. The Caribbean might just beat them to it.”

Naturally, the landscape of building new LNG terminals around the seven seas is a complex and expensive task with huge compliance and technical challenges. It goes without saying that Wärtsilä has all the technical know-how and infrastructure expertise to help its customers in this field. ●



The first LNG shipment delivered to Tornio Manga LNG terminal.

BRIGHT PROSPECTS FOR WÄRTSILÄ'S SOLAR ENERGY STRATEGY

► **TEXT:** DENISE WALL **PHOTO:** WÄRTSILÄ

THE POWER INDUSTRY is undergoing a global transformation. Wärtsilä is leading this change with its growing focus on solar photovoltaic (PV) power solutions.

In a review of the renewables market in 2016, the International Energy Agency, Bloomberg and many others declared that solar will lead the charge of power generation capacity expansion in the next decades, far surpassing wind, hydro and any form of thermal power generation. The bullish forecasts were attributed to buoyed competitiveness in the sector driven by falling technology costs and lower prices.

The very same year, Wärtsilä launched its solar power strategy by introducing utility-scale solar photovoltaic (PV) solutions. The offering comprises utility scale solar PV plants with a capacity of 10 MW and more, as well as hybrid power plants featuring solar PV systems coupled with internal combustion engines or energy storage.

SOLAR PROJECT IN BURKINA FASO HARNESSES ADVANTAGES OF HYBRID LOGIC

Wärtsilä moved quickly to implement the strategy, announcing its first solar power project in Jordan that year. The venture involved modifying an existing 250 MW engine power plant with 16 Wärtsilä 50DF engines delivered in 2014, and complementing it with a solar power plant of 52 MW peak capacity.

This was only the beginning. In March 2017, Wärtsilä announced that it had secured a turnkey delivery of a 15 MW solar PV plant in Burkina Faso.

This also is a hybrid facility featuring a solar power plant constructed alongside an existing 57 MW engine power plant powered by fuel oil. Both operate in a synchronised fashion to create the largest hybrid (engine-solar) of its kind in the world.

The project was undertaken for Essakane Solar SAS, a company majority-owned by global independent power producer EREN Renewable Energy (EREN, 90%) with development partner African Energy Management Platform (AEMP, 10%).

As the operator of the plant, Essakane Solar sells the energy generated to IAMGOLD's Essakane mine. The off-grid gold mine lies 350 kilometres north-east of the Burkina Faso capital, Ouagadougou, and produces approximately 400,000 ounces of gold annually.

Wärtsilä's hybrid plant offers many advantages, particularly for off-grid facilities such as the Essakane mine. Cloudy skies can obscure the sun and reduce the output of a solar unit by up to 80% within a minute. When skies go dark, engines can immediately kick in and compensate for the loss of energy-producing sunlight, automatically boosting by dozens of megawatts per minute if needed. Internal combustion engines are still the only technology capable of providing such a high level of flexibility and responsiveness to power generation.

Moreover, the ability to synchronise and optimise



WÄRTSILÄ'S HYBRID PLANT OFFERS MANY ADVANTAGES, PARTICULARLY FOR OFF-GRID FACILITIES SUCH AS THE ESSAKANE MINE.

The new solar hybrid plant configuration maximises the utilisation of renewable energy at the Essakane mine in Burkina Faso.

the use of engines and solar power could see a reduction in fuel consumption at the mine by roughly six million litres per annum as well as an annual decrease in CO₂ emissions of some 18,500 tonnes.

UTILITY-SCALE SOLAR PV PLANTS IN PIPELINE

Solar PV represented one-third of all the power generation capacity increase globally in 2017, with close to 100 GW added in 2017 out of total of around 300 GW. This was more than any other power generation technology.

This development is expected to strengthen in the next decades, thanks to solar becoming a cheaper way of producing energy than any coal or gas-fired technologies.

Many emerging economies are now prioritising access to clean and reliable power as the bedrock for sustainable social and economic growth. At the same time, developed markets are also prospecting for alternative energy solutions and operational flexibility. These dual trends have opened up new opportunities for Wärtsilä to develop its expertise and footprint in the solar PV market.

The deals Wärtsilä has secured so far are just the tip of the iceberg in what it sees as a rich, renewable energy market. It is increasingly providing solutions for utilities, IPPs and industrial customers in Africa, the Middle East, Latin America and South-East Asia. Rapid growth in the solar sector spells a bright future for the power industry. ●

SHIPPING IN 2020: CHOOSING THE RIGHT FUEL AND PROPULSION SYSTEM

► TEXT: JOHNNY KACKUR ILLUSTRATION: WÄRTSILÄ

STRINGENT ENVIRONMENTAL legislation is starting to hit the shipping industry. The International Maritime Organization's (IMO) Tier III regulations require ships to cut NOx emissions by 80% from the Tier I level within Emission Control Areas (ECAs) and follow a 0.5% cap on the sulphur content in fuel from 2020. These requirements will force ship owners to look beyond today's standard solutions.



Conventional heavy fuel oil (HFO) used by marine vessels contains 3.5% sulphur, meaning ship owners must either buy expensive low sulphur fuel or install SOx scrubbers to meet the cap.

Currently, the only way for ships with diesel engines to meet the 80% reduction in NOx in emissions is to install selective catalytic reduction (SCR) units. These units will now be required in all ships with keel laying in the North American Emission Control Areas (ECA) in 2016 and in the North European ECA in 2021.

But scrubbers and SCRs increase the cost of both building and operating ships. For instance, pumps require electricity, and sludge needs to be removed in port. In addition, SCR units require maintenance.

LNG AS AN ALTERNATIVE FUEL?

Interest in alternative fuels is growing because of the rising cost of diesel fuel, with liquefied natural gas (LNG) looking most promising, with production increasing by 6% to 8% a year, no sulphur and low emissions.

Gas or dual-fuel engines running on gas have 25% lower CO₂ emissions, while NOx emissions are 85% lower than for a diesel engine. This enables compliance with the IMO Tier III levels without the need for an SCR.

The two bottlenecks for LNG use have been

bunkering availability and price. There are barely more than 100 LNG-fuelled vessels, most operating in northern Europe.

However, numbers are predicted to increase to more than 200 by 2019, and ports worldwide are showing an increased interest, which will lead to better bunkering infrastructure.

LOW SULPHUR FUEL, SOX SCRUBBERS OR LNG FOR NEW BUILDS?

It is not easy to guess which marine fuel will dominate in the future, as it is difficult to predict fuel prices.

According to a recent report, (IMO MEPC 70/INF.6), the price spread between 0.5% sulphur fuel and 3% sulphur fuel is USD 130 per tonne, indicating that the payback time for SOx scrubbers will be short compared with running on 0.5% sulphur fuel.

SOx scrubbers or LNG are likely to be more economical in new builds than running on low sulphur fuel, even though the building costs will be higher. LNG-fuelled ships will be the most expensive to build, although costs continue to decrease as the technology becomes more mature.

CASE EXAMPLE - 82K DWT BULKERS

We conducted a cost comparison between SOx scrubbers and LNG machinery on Kamsarmax bulk

carriers (or bulkers). It showed that the initial investment cost of an LNG system is significantly higher, mainly due to the cost of the fuel system.

For the investment to be viable, operational costs must be lower than for SOx scrubbers. According to our calculations for an HFO price of 500 USD per tonne, it would be cheaper to operate on LNG given that the price is lower than USD 12.3 /mmBTU, assuming a payback period of ten years.

The corresponding LNG price for 12.3 USD/mmBTU in tonnes is approximately USD 575 tonne, but the energy content of LNG is more than 20% greater than for conventional HFO. Taking the projected fuel prices into consideration, operation on LNG looks very attractive on a long-term basis.

LNG-FUELLED 82K DWT BULKER: OPTIMISATION OF THE PROPULSION MACHINERY

Standard bulk carrier designs have a single two-stroke main engine directly connected to a fixed pitch propeller with three auxiliary gensets. Until now, the idea has been to change the two-stroke main engine and auxiliary gensets to operate on LNG.

Two-stroke engines are very static, with only one optimisation point – fully laden at service speed, although in actual operation this is often not the case. The redundancy level is not optimal with only one main engine. Gas-fuelled two-stroke engines have

only been in operation since 2016, meaning they are new technology.

An optimised LNG-fuelled Kamsarmax bulk carrier would have two four-stroke main engines for both propulsion and hotel load. Both engines are connected to a reduction gearbox, which connects to a controllable pitch propeller. Instead of auxiliary gensets, power take offs (PTOs) – generators connected to the gearbox – would provide electricity while sailing and in port. Each PTO is connected to a frequency converter, making it possible to run the main engines at variable speeds, lowering fuel consumption at part loads and increasing the propeller efficiency.

The main advantages of four-stroke engines are:

Proven gas engine technology. Four-stroke dual-fuel engines from Wärtsilä have been in operation since 1996 and have accumulated more than 16 million running hours.

Increased flexibility. If the larger four-stroke engine is out of operation, the vessel will still be able to keep a service speed of more than 11 km/h, which also allows for overhaul during sailing. Today's two-stroke engines vessels would go out of operation in case of failure.

The four-stroke engines have CPP installed instead of an FPP, improving manoeuvrability. It is also possible to optimise efficiency of the engine and propeller according to the actual conditions. At variable

speed, a CPP has a comparable open water efficiency to an FPP.

With the newly developed active combinator of the CPP, there is no need to apply margins, as with an FPP. This reduces fuel consumption during transit sailing because equal thrust can be achieved at more fuel-optimised propeller pitch and engine speeds. The 4-S main engines communicate with the smart propulsion control system, allowing the propeller and engine to operate in the most efficient and safe way. This is not possible with an FPP as the design is fixed and margins for worst-case scenarios have to be applied.

Cost optimisation. The four-stroke engine is more cost-efficient than a two-stroke engine, because it has lower power and is less expensive to install.

Fuel contributes a major share of the total operating expenses for a Kamsarmax bulk carrier. The specific fuel oil consumption for a two-stroke engine is generally better than for a four-stroke engine because of the reduction gear and the CPP, but only if the hotel load is not taken into account. The use of the main engines at variable speeds to produce electricity onboard is superior to the use of small auxiliary gensets running at a constant speed.

It helps that the four-stroke machinery weighs about a third as much as a two-stroke engine and is significantly smaller in size. Replacing the two-stroke

engine with four-stroke engines will provide a large empty space above the engines. This empty space can be utilised for increasing the cargo capacity.

CONCLUSIONS

For new builds today, emissions legislation is a game changer. As the price of low sulphur fuels will most likely be high, LNG and after-treatment are both attractive options. New builds with after-treatment units are less expensive than LNG-fuelled ships, and therefore also seem to be the more attractive of the two options. The increase in LNG supply will most likely mean lower prices and few availability problems. Therefore the use of LNG as fuel is appealing in the long term, even with the higher investment costs considered.

Proven technology, increased flexibility and cost optimisation are very strong arguments for choosing four-stroke machinery over two-stroke engines for LNG-fuelled ships. The shipping industry has always been conservative as massive capital investment is required. Those who adapt will have the opportunity to earn large profits. ●

THERE'S A NEW SHIP ON THE HORIZON

► TEXT: ALEXANDER FARNSWORTH ILLUSTRATION: WÄRTSILÄ

THE ARGUMENT FOR THE NEW LNG bulk carriers, currently on the drawing boards, is based on life cycle costs and not unit prices. Despite the commodity value chain that bulk carriers represent (tonnage is the name of the game in this volume segment), the adoption of LNG as a primary fuel could change the industry forever.



The aptly named Forward Shipping Company (FSC) doesn't have any boats yet. But if all goes according to plan, their newly proposed fleet of 20 or more LNG-propelled bulk carriers will future-proof the industry into environmental compliance. There are few other alternatives.

New and looming IMO shipping standards are going into effect in 2020 to basically put a cap on NOx and SOx emissions produced by diesel and heavy fuel oil (HFO)-burning ships. The Forward Maritime Group Ltd was formed in 2013 when the Greek Arista Shipping S.A. jointly developed an R&D project with a prestigious and powerful group of industry leaders, including Wärtsilä, to promote the adoption of LNG as a marine fuel and make its use a new standard. Their research is now coming to fruition.

A letter of intent was signed in April 2018 between the Forward Maritime Group and the Jiangsu Yangzijiang Shipbuilding Group in Singapore for the construction of up to 20 Forward Bulker 84-LNG bulk carriers with deliveries between 2020 and 2023. When delivered, these vessels will be trading under the "Forward Ships" brand.

Even more newsworthy for Wärtsilä, Eniram, a Wärtsilä company, signed a memorandum of understanding (MoU) in late May 2018 with Forward Ships to assist in the development of monitoring and optimisation tools including the Energy Efficiency Design Index 2025, SOx post 2020, and NOx Tier III without any after treatment.

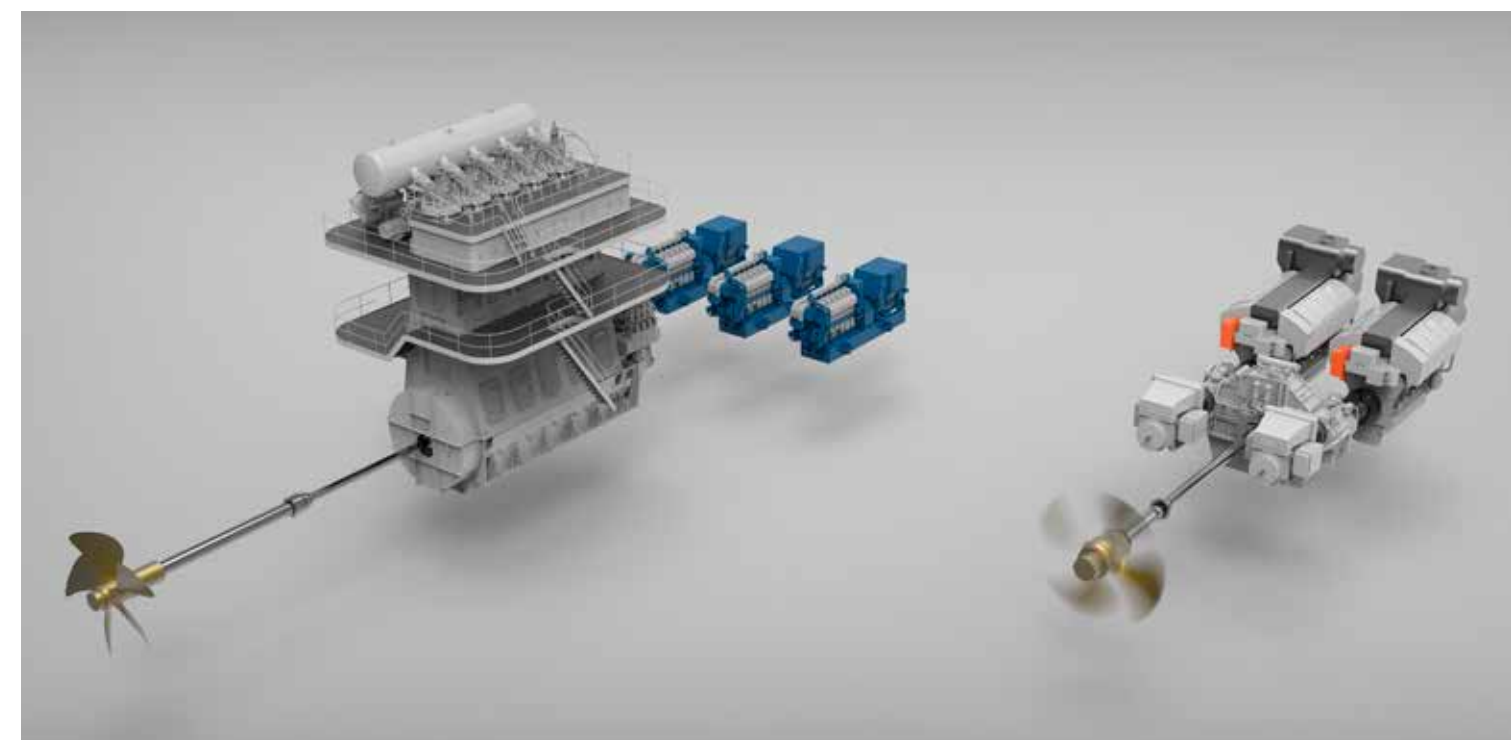
"Bulk carriers are the single biggest shipping segment in the world," says **Johnny Kackur**, Business Development Manager, Wärtsilä Marine Solutions. "We are delighted to be part of this exciting project, which will create a vessel with the levels of performance and sustainability needed as the marine industry enters a new era. Our input will help ensure operational visibility is maximised, and that the new ships operate at optimal efficiency."

WHO IS THE CLEANEST OF THEM ALL?

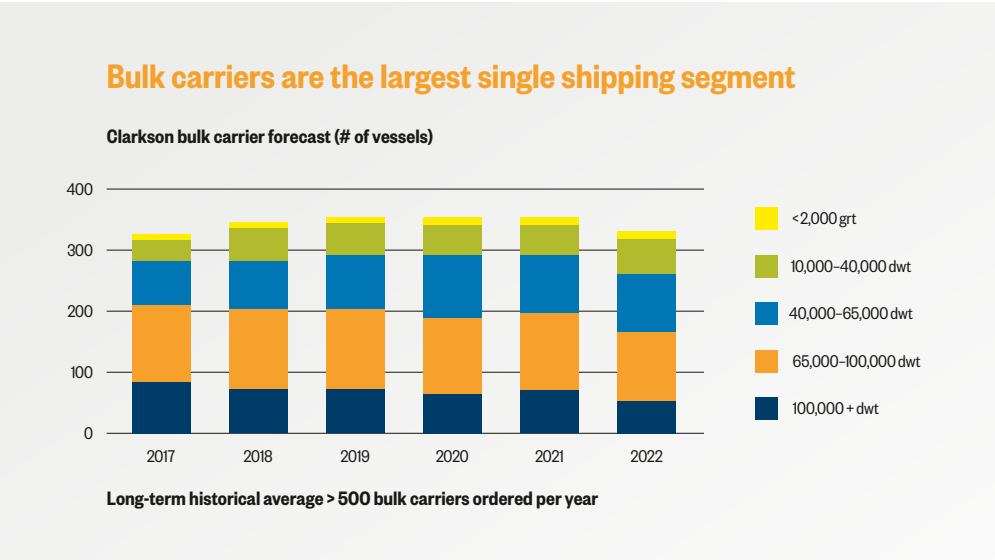
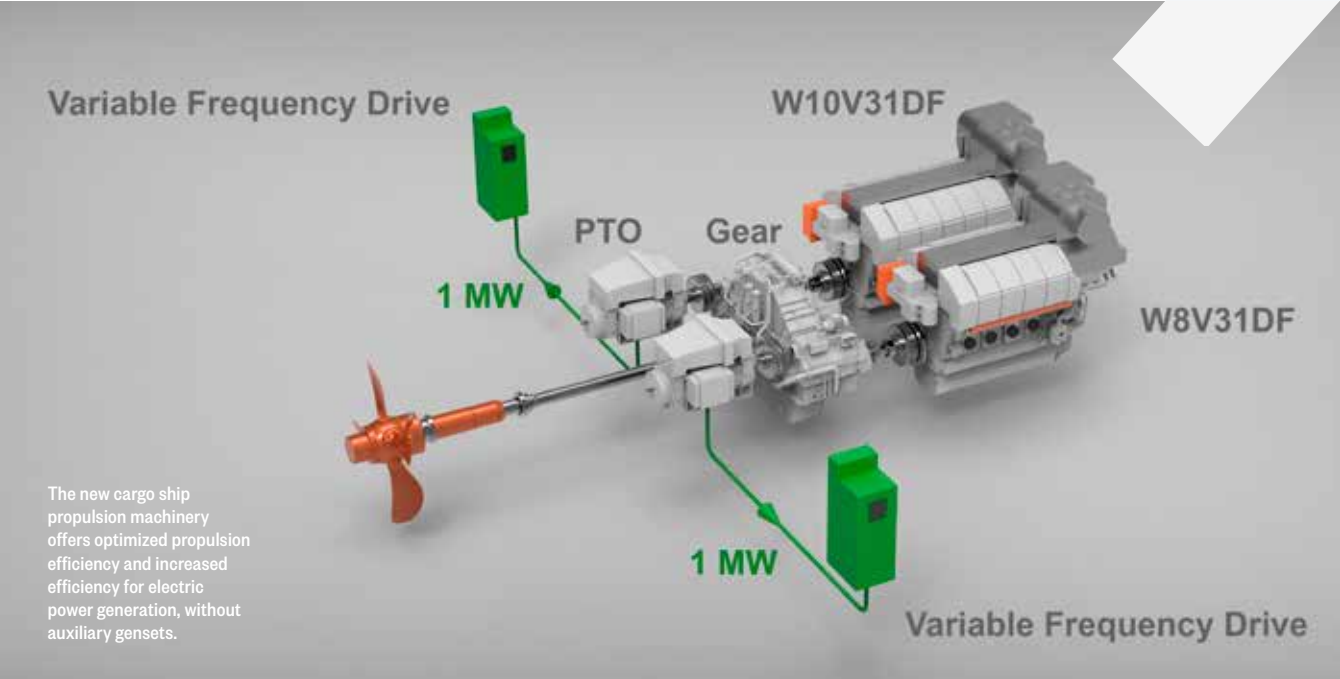
Wärtsilä is also deeply involved in Project Forward because of its experience in LNG propulsion technologies. The propulsion design concept for the 20 new ships being developed is to be based on a novel arrangement featuring just two highly efficient Wärtsilä 31DF dual-fuel engines without additional gensets.

The new series of bulk carriers, dubbed "The Cleanest Cargo Ships in the World", will be the first large-scale implementation of LNG as a fuel, and the most environmentally friendly. They will emit up to 35% less CO₂, 80% less NO_x, 99% less SO_x, and 99% less particulate matter (PM) than conventional ships. Project Forward aims to take the lead in reducing CO₂ emissions from shipping. Shell, a Project Forward partner, calls Project Forward's ships a "game changer" and is ready to accelerate the roll-out of LNG bunkering infrastructure for the launch in 2020.

THE NEW SERIES OF BULK CARRIERS, DUBBED 'THE CLEANEST CARGO SHIPS IN THE WORLD', WILL BE THE FIRST LARGE-SCALE IMPLEMENTATION OF LNG AS A FUEL, AND THE MOST ENVIRONMENTALLY FRIENDLY.



Standard cargo ship machinery compared with the new modern compact cargo ship machinery.



Project Forward's partners include:

1. **ABS** (American Bureau of Shipping, one of the world's leading ship classification societies)
2. **SHELL** (Shell Western LNG B.V., a leading supplier of LNG marine fuel)
3. **GTT** (Gaztransport & Technigaz, the leading engineering company specialised in the design of membrane containment systems for the maritime transportation and storage of liquefied natural gas)
4. **DELTAMARIN** (a ship design, offshore engineering and construction group operating in the marine and offshore industries worldwide)
5. And **WÄRTSILÄ**

But it isn't all smooth sailing. "LNG is no doubt the way forward as it significantly reduces the enormous amounts of pollutants you get from HFO and diesel," says Kackur. "But at the moment, LNG is not a viable fuel for the merchant fleet, meaning it is not as widely available as its alternatives. Shell is working hard on guaranteeing the supply of LNG, though. So it is a little bit a chicken and egg problem. The industry, and Arista in particular, is drawing a line in the sand with LNG." Currently, the existing alternatives on the market

to comply with the new IMO 2020 NOx and SOx regulations include installing expensive SOx scrubbers or using even more expensive low-sulphur diesel fuel. In this constellation, LNG is also an expensive proposition in part because of the onboard pressure tanks that are required to keep LNG at -161 °C in its liquid phase, and the added expenses that are incurred while building such LNG-propelled ships. "Like any new solution in an established industry, these extra costs have to be absorbed throughout the value chain – a higher vessel price requires a higher

chartering cost, for example – and there are still many questions to be asked and answered about the commercial viability of LNG," says Kackur. "There is always another way of looking at it. "Bulk carriers – which carry dry bulk like coal and iron ore around the world – are the biggest single shipping segment comprising 15–17% of the world's merchant fleet, with between 350 and 500 new ships built every year. If you can make a change here, you can reengineer the whole market," concludes Kackur. ●

TEXT: ANNE SALOMÄKI PHOTO: MARJA VÄÄNÄNEN

Operational Excellence comes with the flow

If you could watch a customer journey like it was a movie, what would you do differently? In May, Wärtsilä's Unleash Operational Excellence event in Helsinki dived into Operational Excellence (OE) with pragmatic examples and intriguing metaphors. During the two days, 100 OE Change Leaders shared best practices and listened to external experts give their two cents regarding OE and its effect on workflow. **Niklas Modig**, researcher at the Center for Innovation and Operations Management at the Stockholm School of Economics, pointed out that companies should be managed the way cars are driven: never losing focus and

continuously making adjustments to deviations on the road. This can be done by imagining a customer journey as a film. "If all managers put themselves in a customer's shoes, they'll be able to deliver instant customer value," Modig said in his keynote speech. The aim of Wärtsilä's OE initiative, launched almost three years ago, is to make busy people take a step back and see not only what is going on, but also why – and how it could be improved. This way, it switches focus from resource efficiency to flow efficiency. "In a rush, people tend to do things that might not be needed at that moment, and cause multi-

tasking to others," noted Wärtsilä's Operational Excellence Director **Fredrik Nordström**. "This is the efficiency paradox: by hurrying we end up not being as efficient as we could be." Most importantly: the goals must be customer-centric and shared throughout the organisation. "With Operational Excellence, organisations move from local optimisation to optimising the whole value chain, involving not only production but the entire business," Nordström said. After the event, Change Leaders went back to work with heads full of ideas and practices to be shared with others.

Sign off

AT YOUR SERVICE | CLASSIC | AMBITION | LITTLE ENGINEER | COLUMN

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[AT YOUR SERVICE]

"I'm a builder!"

WITH THE ACQUISITION of Puregas Solutions in October 2017, Wärtsilä now has a very strong position in the growing biogas for transport market. We sat down with Puregas CEO **Jan Molin**, who incidentally started his career at Wärtsilä in the early 1990s, and asked him a few questions about this winning scenario.

1 HOW EXACTLY WILL PUREGAS COMPLETE WÄRTSILÄ'S PORTFOLIO?

Firstly, Puregas gives Wärtsilä a solid footprint as a turnkey supplier, downstream of anaerobic digestion, in the fast-developing biogas industry. Wärtsilä is now the only supplier in the market with a well-proven in-house solution to produce vehicle fuel, both LBG (liquefied biogas) to replace LNG (liquefied natural gas) and OBG (compressed biogas) to replace CNG (compressed natural gas). It is a very strong position to be in. In the bigger picture of things, the Puregas acquisition fits very

nicely with Wärtsilä's stated goal of becoming an enabler of a sustainable society.

2 WHERE COULD AN AVERAGE PERSON COME IN CONTACT WITH BIOGAS PURIFICATION TECHNOLOGY?

Biogas is a very concrete product that a normal person would come into contact with when fuelling a gas-driven car and/or cooking at home with gas, for example, or by simply hopping onto a city bus. Biogas is used everywhere and its production is getting more mainstream.

"I HAVE SPENT MY ENTIRE CAREER SETTING UP BUSINESSES ACROSS DIFFERENT INDUSTRIES."

3 WHAT IS THE BIGGEST CHALLENGE IN YOUR NEW JOB?

I have spent my entire career setting up businesses across different industries. Coincidentally, I started at Wärtsilä after my university studies in Lund, Sweden, as a CFO for an engine manufacturing division in 1990. So, it is nice to be back. But I am a builder and I like building things up. The challenge here is to maintain the entrepreneurial speed and creativity that Puregas is known for while making use of all the expertise, global coverage and financial strength that comes with the Wärtsilä offer. What is particularly nice is that Wärtsilä didn't just purchase our technology; they've also shown a lot of appreciation and respect for how we have structured our business. This is good because we are really leading the development of biogas sector and there is a lot to build on, together.

sign off

TECHS & SPECS

Production

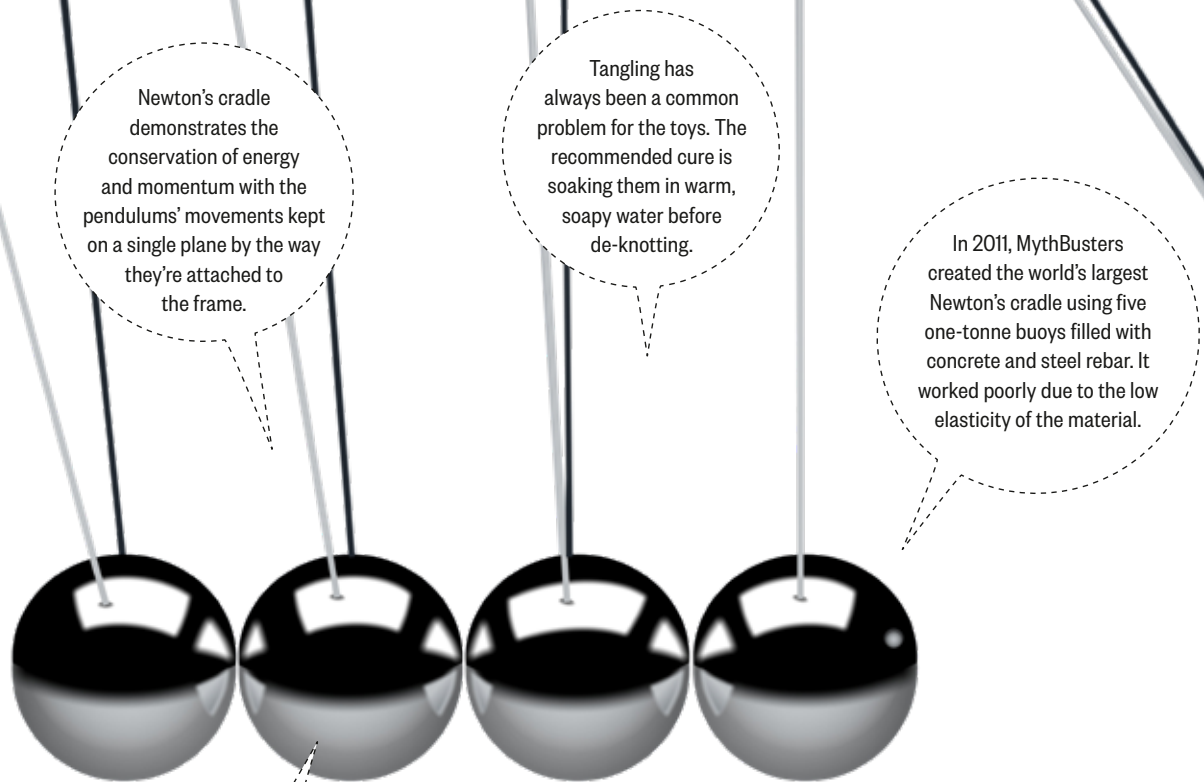
Late 1960s – present

Materials

Hardened steel or chrome, metal wire or nylon thread

ORIGIN

As irresistible as it is irritating, **Newton's cradle** is by far the most recognisable executive toy of the 1970s and 1980s. Though it is based on the principles sketched out by 17th-century physicists, credit for coining the name and popularising the gadget goes to English actor **Simon Prebble**, who introduced his wooden version in Harrods of London in 1967.



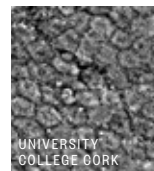
[CLASSIC]

The clack heard round the world

Newton's cradle became a generic term for the gadget. Others are Newton's Balls and Executive Ball Clicker. Prebble's wooden Newton's cradle was quickly outdone by the chrome version designed by English sculptor **Richard Loncraine**, who went on to become a celebrated film director.

Execs who take their office on the road can opt for the iPhone version of the Newton's cradle, which is no doubt every bit as useful as the original.

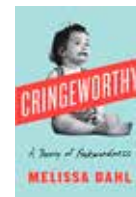
[SCIENCE]



History's oldest known case of dandruff has been discovered on the skin of a feathered dinosaur that roamed the Earth 125 million years ago. After palaeontologists unexpectedly came across the tiny skin flakes while examining a fossil of the crow-sized micro raptor, they found similar flakes on those of two other non-avian dinosaurs and a Cretaceous-era bird. The discovery, published in *Nature Communications* in May, sheds new light on how dinosaurs shed skin.

[CULTURE WATCH]

[LITERATURE]



Could life's most awkward moments actually be untapped opportunities for personal growth? In her thought-provoking and hilarious book *Cringeworthy: A Theory of Awkwardness*, New York magazine's health and psychology editor **Melissa Dahl** deliberately throws herself into the most wince-provoking situations imaginable, exploring the insights they can reveal about ourselves and the ridiculousness that unites us as humans.

[TECHNOLOGY]



US spy agencies are looking into a novel use for DNA: large-scale data storage. IARPA, part of the Office of the Director of National Intelligence, has announced plans to develop machines that can store and retrieve data from large batches of polymers. These string-like molecules, including DNA, can store data in the sequence of individual atoms or groups of atoms, potentially alleviating serious energy problems stemming from the world's rapidly growing data centre needs.

Is zero emissions shipping even possible?

Oil analyst turned green soothsayer Thina Margrethe Saltvedt discusses how innovation and turmoil is fertile ground for the shipping industry.

Oil's days are numbered. For **Thina Margrethe Saltvedt**, 46, becoming a senior adviser in Sustainable Finance at Nordea Bank in January 2018 was both a personal and professional choice.

"I worry about climate change on a deep, personal level," says Saltvedt. "The environmental changes we've seen are really scary. But we still have time to do something about it. Professionally, the sustainability industry is very exciting because there are so many problems still to solve, and so many new technologies, solutions and ideas to develop."

Saltvedt has spent the last decade analysing the now very mature oil markets, their swings and moves. Before Nordea, she held a position with Norges Bank within the financial stability area. With a background in ballet, Saltvedt has a Ph.D. in economics from the University of Manchester Institute of Science and Technology (UMIST), the UK. She is one of only a few female energy analysts in the world.

In her new role, Saltvedt aims to look at the macroeconomic or big-picture issues.

She believes that for the green and sustainable revolution to really take effect around the world, it will be crucial, first and foremost, to make the technologies profitable. This is already happening in the automotive industry as batteries become cheaper to manufacture.

"I mean, a car is basically a small computer these days," says Saltvedt. "In general, shipping is taking cues from the automobile industry but is still lagging a little behind waiting for the first mover."

This could be because energy supplies from oil, gas and coal have historically had great political consequences between the haves and have nots in the world. But theoretically, since everyone has access to solar, wind and water, the question of accessibility will be based more on the availability of technology and not the actual resource.

"The world hasn't yet reached a tipping point with regard to sustainable technologies (my best bet at the moment is 2025 at the earliest), but the changes that are happening to the energy sector are faster than anyone thought possible," Saltvedt says.

"Future winners will be those that grapple with the technology early on. That much we can say for sure."

THE DOMINO EFFECT

"If one is to learn from the past, a trigger of some sort is required to make companies and authorities develop new solutions to a problem. For example, the sky-high oil prices

in 2008 meant that fishing boats could no longer fish, which led to a push to developing new sources of energy. Today, the problem is climate change, which the UN says is the biggest problem facing mankind, and we all know the effect of this."

While slower to adopt change compared with more consumer-based industries, the shipping sector is facing its own cargo-load of imminent green issues. The first issue is the IMO's 2020 deadline for lowering sulphur and NOx emissions which will require a major rethink by shipping companies to find alternative fuels and technologies.

"Fuel-scrubbing technology has been developed and batteries have been successfully used in some coastal ferry applications, but the industry in general seems to be waiting to see what the next guy will do," Saltvedt says.

SHIPPING'S FUTURE

That said, it cannot be denied that shipping as a market has its own unique characteristics – ships cost millions to build and operate, unlike personal cars – but to truly develop green shipping will require a new way of looking at what shipping really is.

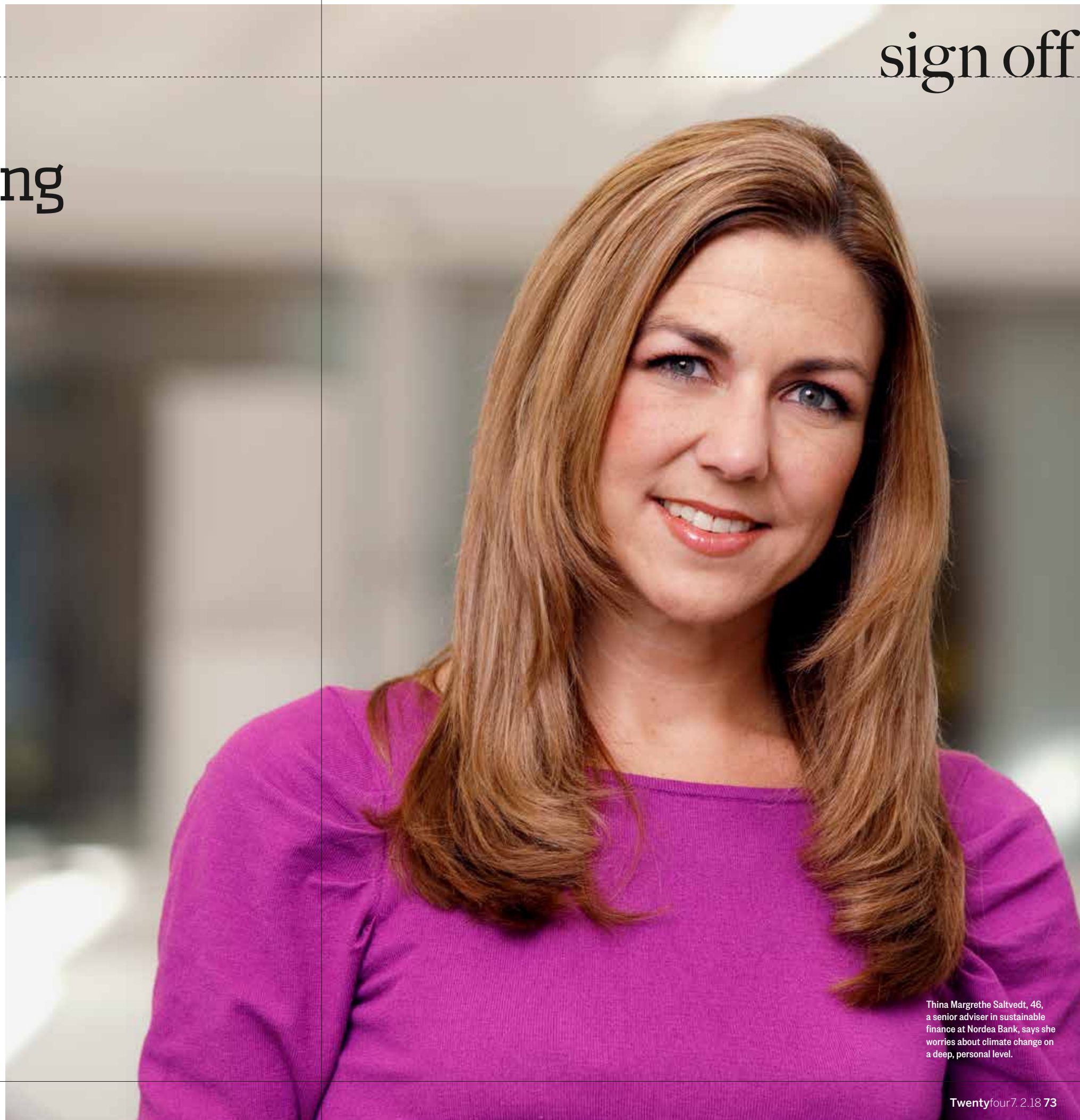
"With 3D printing technology, maybe we won't need shipping in the future as much as we do now. What are the world's transportation requirements for goods and logistics in the future? Goods can already be moved from a train to a ship automatically without human involvement, so maybe more automation is key. Maybe doing this will lead to new business models just like it did with the auto industry. Who knows?"

Saltvedt says one thing will certainly put the screws on the shipping industry.

"Credit rating agencies like Moody's and S&P are planning to include climate risk in their credit risk rating models of companies and countries, so there is an incentive to find alternative and greener modes of shipping," she concludes. ●

"THE ENVIRONMENTAL CHANGES WE'VE SEEN ARE REALLY SCARY. BUT WE STILL HAVE TIME TO DO SOMETHING ABOUT IT."

Thina Margrethe Saltvedt, 46, a senior adviser in sustainable finance at Nordea Bank, says she worries about climate change on a deep, personal level.



[TRAVELLERS' GEAR]



Want the convenience of a travel backpack but worry it'll make you look like a scruffy grad student? The stylish **Pro Executive Laptop Backpack** by WaterField Designs features a dignified, non-sag design, with plenty of quick-access pockets. It comes in chocolate, crimson, grey and black.



Security-minded travellers who like a touch of tech should check out the **Tapplock One**, the world's first smart fingerprint padlock. The sturdy, smartphone-linked device unlocks in under 0.8 seconds and can store the loops and swirls of up to 500 different users.

The last thing you need on a business trip is someone's lint or cat hair fuzzing up your fashion. The **Flint compact roller** quickly removes the offending fibres with the help of easy-to-tear sticky sheets. It's refillable and collapses down to 14 cm for easy packing.



TEXT: STEVE ROMAN



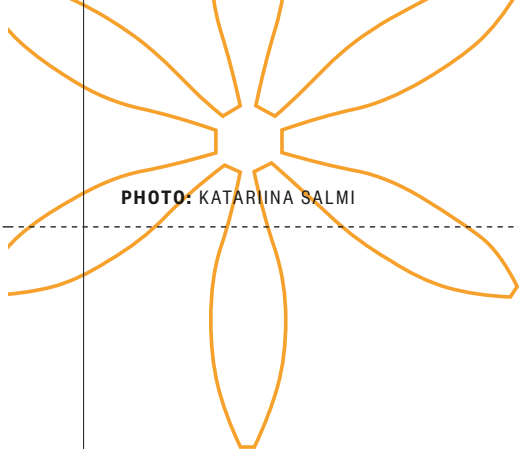
[LITTLE ENGINEER]

Clean energy from mud

A LITTLE DIRT NEVER HURT ANYONE, or so generations of scout camp leaders kept trying to convince us. Now, a California-based start-up is doing them one better, showing little engineers how the mud they play in can actually be a renewable power source thanks to the menagerie of microbes living within. MudWatt, an award-winning fuel-cell kit by Magical Microbes, relies on the micro-organisms found in soil – any soil – to produce chemical energy. This is then converted to electrical energy to power a clock or a blinking LED. A far cry from the old potato clock, MudWatt uses principles of microbiology, decomposition, nutrient cycling, soil chemistry, biochemistry and electrical engineering. It can produce power for years so long as the microbes thrive.

The classic kit comes with the vessel, an anode, a cathode, the LED blinker board, a pair of nitrile gloves and a 20-page educational/instruction manual. After the initial set-up, which takes under an hour, users measure and track the energy output of their little community for two weeks. They can also experiment by adding things from the fridge, like sports drinks and dubious leftovers, to maximise the power. The happier the microbe cultures are, the faster the LED blinks. To keep the excitement-level high, there's a free MudWatt Explorer App that lets kids unlock new chapters of "The Electric Microbe" comic as they track the growth of their microbe populations. Recommended for ages eight and up.

PHOTO: KATARINA SALMI



sign off

Investing in the future

THE ENERGY LANDSCAPE IS GOING through an unprecedented transformation. Recently, I had the opportunity to listen to a utility customer and an independent power producer, both from the USA, share their stories. A few years ago, they had very limited renewable assets in their portfolio and they had never heard about Wärtsilä. Today, they are on a quest to rapidly convert to renewables and Wärtsilä's flexible solutions are able to support them on that path. This mirrors the sweeping change that is under way in the energy sector. While a few years ago, utilities and independent power producers (IPPs) were still investing in conventional coal and gas turbine power plants to power their grids, today they are witnessing the rapid rise of renewables. The reason to invest in renewables is pure economics. Renewable energy today has become more affordable and is emission-free compared with fossil fuels, making the power system sustainable. This has caused many utilities to adopt renewables, gradually turning them into the base load for their power grids. As the energy sector embraces renewables, there are bound to be hiccups along the way. Chief among these are the intermittent nature of renewable power and the struggle of many utilities to make the switch in an informed manner. As utilities invest in renewable assets like wind and solar, they have begun to realise that their current gas turbine and coal assets are not flexible enough to integrate renewables, which can then cause problems in power system reliability. Through our Smart Energy Vision, Wärtsilä will lead the transition to a 100% renewable energy future. We can help our customers truly understand the opportunities that this energy transition provides. We can help provide them with the flexibility needed to facilitate the integration of intermittent renewable energy – whatever the technology mix (engines, solar, storage, hybrids), in the most cost-efficient way. As an energy system integrator, Wärtsilä understands the role of different technologies as part of our customers' power systems. We can help them create an optimal path towards 100% renewable energy systems by designing, building and providing complete solutions across the entire energy generation life cycle. While turning to renewables is a nice message, it is also a reality and one that will decide the future of energy markets. It is essential that the energy sector invests in flexible generation now so that it can eventually make the full transition to renewables. We are here to help them.

Anja Frada
Vice President Business Development
Finance & Control Energy Solutions, Wärtsilä