

here



THE EVOLUTION OF SERVICE

– from repairs and maintenance to proactively adding value for customers

THE BLACK LAGOON

Toxic hazard turned into marketable crude in Kazakhstan

GOING UNDERCOVER

Move indoors makes Moscow markets safer and cleaner

BEST IN TEST

Helping the marine industry meet tough environmental targets



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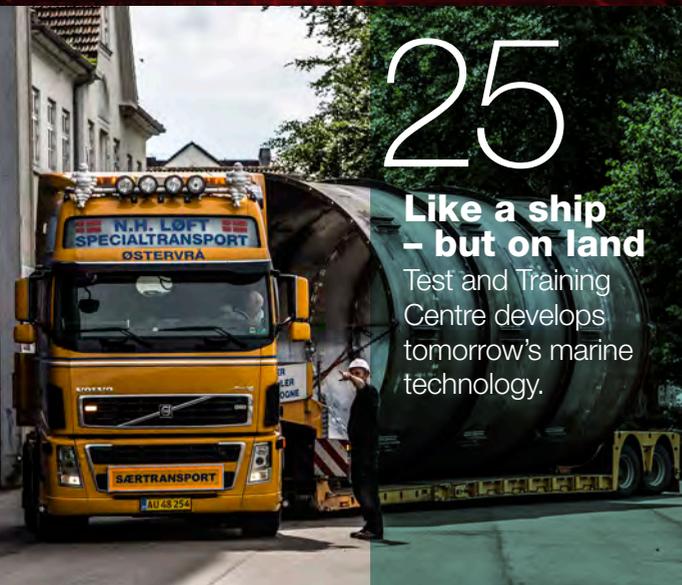
Cleaning up in Kazakhstan

Turning waste oil pollution into profit.

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Test and Training Centre develops tomorrow's marine technology.

The need for speed

editorial These are exciting times at Alfa Laval.

As you may have heard, we are reshaping the company with the main objective to better understand and meet the needs of our customers and business partners. Our watchwords in this work are speed, responsiveness and reliability.

In fact, my personal goal is that in two years from now, when I talk to our customers, I want to hear something along the lines of: “Yes – I can feel the difference, you have really speeded up. You are fast and responsive and your offer is really attractive!”

AN IMPORTANT PILLAR in our new direction is that we will continue to build on our technological strengths. Our three key technologies – heat transfer, separation and fluid handling – and core product groups will remain the backbone of the company and, based on insights from the market, we will focus our R&D on areas that make a difference and add value to our customers’ processes.

Another major focus area for us in recent years has been service, and that development will continue with increased efforts. It is all about providing solutions to the customers’ problems, rather than just supplying them with goods.

As another Swedish CEO has put it, we manufacturers may know it as ‘aftermarket’, but we are well aware of that to our customers this is their daily business. We have made ‘service’ the theme of this edition, and we investigate this paradigm shift from reactive maintenance to proactive service and support.

WE WILL ALSO visit the Alfa Laval Test and Training Centre in Aalborg, Denmark, where we are working on solutions to the marine industry’s

challenges, such as combustion technologies for the world’s growing fleet of liquid natural gas tankers.

We report from one of the world’s most iconic cities, Venice, which, as you are probably aware, is under dire



threat from flooding. We are proud to be part of the solution to that threat, and you can read the full story of this engineering marvel.

OUR CORRESPONDENTS also report from Moscow, where consumers no longer have to run the gauntlet at the city’s notorious food markets but can shop safer and fresher at the massive Food City facility. And from Kazakhstan, where we bring you the fascinating story of how a local entrepreneur is using Alfa Laval technology to recycle waste oil that has long polluted the landscape.

I hope you will agree that it all makes for interesting and inspiring reading!

TOM ERIXON
PRESIDENT AND CEO
ALFA LAVAL GROUP

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BAD NEWS FOR INVASIVE SPECIES WITH DOUBLE MILESTONE

Untreated ballast water that spreads invasive aquatic species such as bacteria, microbes and small invertebrates is a huge global problem. It can cause serious, often irreversible damage to local ecosystems and biodiversity, as well as grave economic consequences.

Increasing seaborne trade has accelerated the problem, so when Finland ratified the UN's International Maritime Organisation (IMO) Ballast Water Management (BWM) Convention in September 2016, the drawn-out ratification process was completed to sighs of relief.

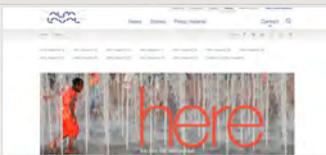
Phased in from 8 September

2017, the BWM Convention specifies the requirements for ships engaged in international trade when managing their ballast water and sediments.

The ratification coincided with the ten-year anniversary of the launch of Alfa Laval PureBallast. The world's first commercially available chemical-free ballast water treatment system, Alfa

Laval PureBallast received US Coast Guard type approval at the end of 2016. The product range, now in its third generation, is still the go-to solution, providing superior performance in fresh and brackish as well as marine waters. To date, more than 1,200 systems have been sold with more than 300 installed as retrofits.

ONLINE



HERE MAGAZINE GOES ONLINE

An online version of *Here magazine* can now be found at www.alfalaval.com, giving even wider global access to the unique mixture of industry insight, trends, inspiration and news from the world of Alfa Laval.

Here online is currently available in English, and during 2017 more languages will be added.

All *Here online* content will be promoted in Alfa Laval's social media channels, so follow our Facebook and LinkedIn accounts to get access to a regular flow of news, articles and more.

2017 WILL BE A LANDMARK YEAR FOR ALFA LAVAL IN MANY WAYS, WITH A NUMBER OF SIGNIFICANT ANNIVERSARIES:



Alfa Laval New Zealand: 90 years

Alfa Laval India: 80 years

2017 also marks Alfa Laval's century as a supplier to the marine industry. It was 100 years ago that the company delivered its first separator for fuel treatment on-board vessels.

Top performance earns certification

A range of Alfa Laval CB brazed and AlfaNova fusion-bonded plate heat exchangers have earned the trusted AHRI Certified™ mark. The products will be marketed as Alfa Laval CBAQ and AlfaNova AQ.

Products certified by AHRI (Air Conditioning, Heating & Refrigeration Institute) undergo rigorous, independent annual evaluation to ensure that they perform according to manufacturers' claims. This simplifies comparison for customers.

Today's HVAC market is heavily competitive, which means manufacturers often under-dimension heat exchangers to get price advantages. The AHRI performance certification corrects this and gives manufacturers incentives to develop new and more efficient solutions.

Bright outlook for food and energy sectors in North West Africa

The rapid development of the food and energy industries in North West Africa is expected to drive demand for processing equipment in the region.

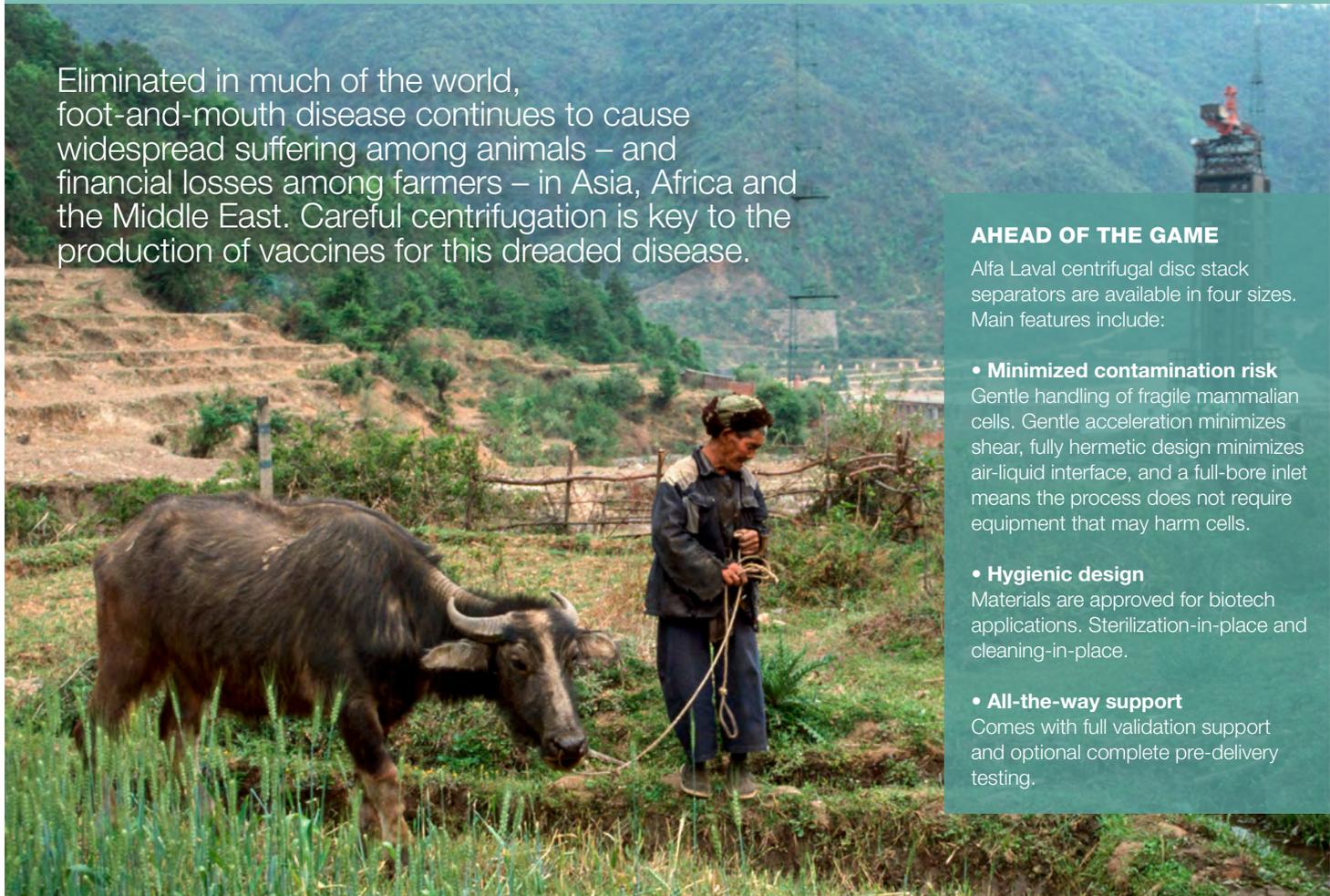
Africa is the world's largest and the second most populous continent, with Algeria the largest country by area and Nigeria by population.

"These figures make us strongly believe in North West Africa development and that is why we have invested in the creation of a Sales and Service organization in this region," says Julien Gennetier, Managing Director Alfa Laval France & North West Africa.

The organization will focus on the oil and gas industry, the power, marine and diesel business as well as the food and beverage industries.

How to stamp out foot-and-mouth

Eliminated in much of the world, foot-and-mouth disease continues to cause widespread suffering among animals – and financial losses among farmers – in Asia, Africa and the Middle East. Careful centrifugation is key to the production of vaccines for this dreaded disease.



AHEAD OF THE GAME

Alfa Laval centrifugal disc stack separators are available in four sizes. Main features include:

- **Minimized contamination risk**
Gentle handling of fragile mammalian cells. Gentle acceleration minimizes shear, fully hermetic design minimizes air-liquid interface, and a full-bore inlet means the process does not require equipment that may harm cells.
- **Hygienic design**
Materials are approved for biotech applications. Sterilization-in-place and cleaning-in-place.
- **All-the-way support**
Comes with full validation support and optional complete pre-delivery testing.

As living standards improve across the world, so grows demand for meat. Annual meat production is projected by the World Health Organization to increase from 218m tonnes in 1997–1999 to 376m tonnes by 2030. Satisfying this huge demand comes with many challenges. One is to handle the dreaded foot-and-mouth disease (FMD), which, apart from making animals suffer intensely, may lead to severe economic consequences, even bankruptcy of farming businesses, and also to a shortage of product. The solution is a combination of vaccination, monitoring, trade restrictions and quarantines. FMD vaccines are the dominant veterinary vaccine. They are produced in a multi-stage process, using killed virus preparations grown in mammalian cell culture. To remove cell debris from the target proteins during the harvesting stage, centrifugation is common. However, extreme care has to be taken not to damage the fragile cells. “If cells break during separation, fragments might contaminate the product. This compli-

cates downstream processing, affecting the quality; it might spoil the whole batch,” says Rikard Krook, Market Unit Manager Life Science at Alfa Laval. “Our customers came to us with this problem, asking for a better solution.” Alfa Laval’s engineers have, for many years, been investigating and developing low-shear concepts for biotech separators. Firstly, the patented disk inlet and more recently the unique fully hermetic, hollow spindle Culturefuge range of separators. Combining these technologies with steam-sterilisable units with high levels of containment for biologically hazardous applications, has been critical for success in this demanding industry. “Both the short- and long-term trends look good,” Krook says. “This applies to both animal health and human therapeutics. There is a huge pipeline of new generation vaccines, cancer drugs and monoclonal antibodies under development. Biopharmaceuticals are still in their infancy, and the only way is up.”

3 FACTS ABOUT FOOT-AND-MOUTH DISEASE

- FMD – also hoof-and-mouth disease – is a highly contagious viral disease that affects both domestic animals and cloven-hoofed wildlife.
- It typically causes blisters on the hoofs and in the oral cavity, as well as other serious symptoms. Affected animals generally recover, but are often weakened and debilitated.
- There are seven strains with multiple subtypes, each requiring its own vaccine, which complicates control of the disease, as does the fact that the virus replicates rapidly.

THEME SERVICE



"Creating value is what service management is about". Telematics features, such as sensor-based reporting on car maintenance and usage, give automakers the chance to forge a closer relationship with customers while increasing margins.

AT YOUR SERVICE!

TEXT: GREG MCIVOR PHOTOS: GETTY ILLUSTRATION: DAN HAMBE

Recent years have seen a fundamental change in the way manufacturers regard their service business. Long seen as something of an afterthought to the core business of selling products, service – or after-market – has become a way to stand out from the crowd by focusing on solving customers' problems in the longer term, and helping them be more competitive, rather than just selling to them. Martin Lundstedt, CEO of the Volvo Group, hit the nail on the head when he said: "I don't like the word 'aftermarket', because it is the customer's *main* market."



“The goods and service divide is obsolete. Services have become the key to unlocking the value of physical goods.”

BO EDVARDSSON,
FOUNDER OF THE SERVICE RESEARCH CENTRE
AT KARLSTAD UNIVERSITY, SWEDEN.



Henry Ford, who was both the father of the motorcar and a business visionary with an instinctive knack for spotting the commercial sweet spot, was early to see the potential of service: “A business absolutely devoted to service will have only one worry about profits,” he once remarked. “They will be embarrassingly large.”

JACK WELCH, who ran General Electric from 1981 to 2001, had this take on the service question: “Your challenge is not just to

improve. It’s to break the service paradigm in your industry or market so customers aren’t just satisfied, they’re so shocked they tell strangers on the street how good you are.”

And of course this is exactly what service suppliers should be striving to do – exceeding customers’ expectations by anticipating and solving their problems before they happen.

For decades, many corporations were slow to crack the paradigm, often tending to see service as a sideshow to their main business of selling products. But that is changing.

Economic pressures, and the worldwide commoditization of equipment and hardware, are forcing manufacturers to find new ways to differentiate themselves from the competition.

Many are seeking to build a closer relationship with their customers – a relationship built on service that provides customers with peace of mind, uptime, more effective processes and cost savings, rather than just supplying goods.

Bo Edvardsson, Professor of Business Administration and founder of the Service



Rolls-Royce – revving up in service

Few manufacturers have embraced service with as much enthusiasm and success as the world's second-largest maker of aircraft engines.

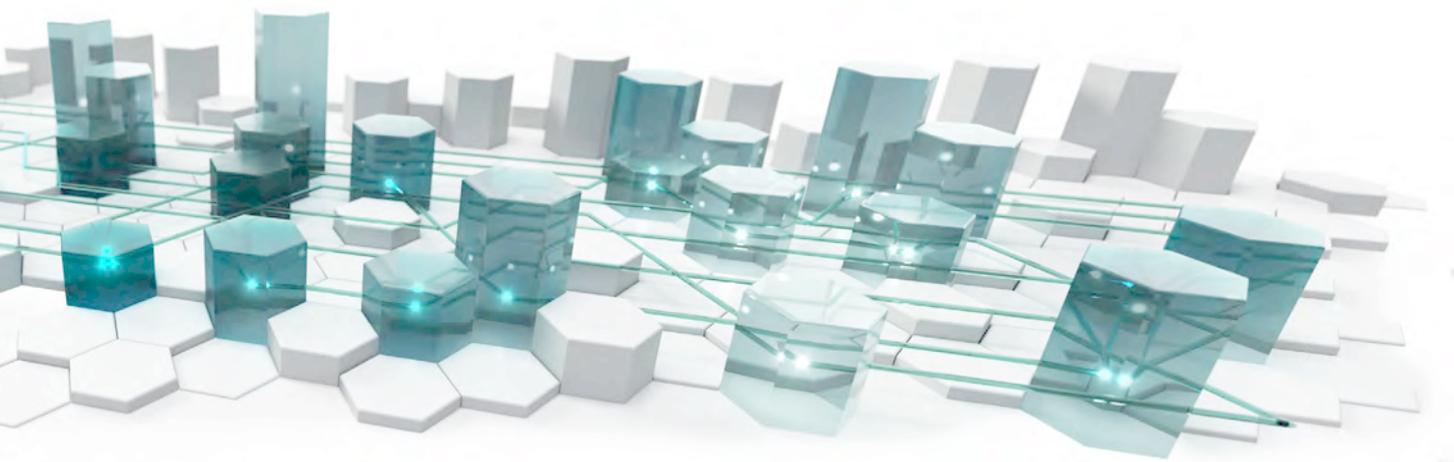
In a few decades, the UK-based company, which also operates in the marine propulsion and energy sectors, transformed itself from a loss-making business into an industry champion. How? By blurring the lines between engineering equipment and offering services.

Rolls-Royce's old model involved selling engines and then, some years later, spare parts. Then the company reinvented itself as a service provider, providing airlines with "power by the hour" via a package of "total care" that focuses on long-term repair and maintenance.

Their customers get fixed and predictable engine maintenance costs over an extended period of time, and avoid the costs associated with unscheduled maintenance and breakdowns.

So, while Rolls-Royce continues to manufacture engines, it now also focuses closely on maintaining those engines and solving any problems that may arise during their lifetime.

Today, service accounts for more than half of Rolls-Royce's annual sales, and the business is highly profitable a classic example of how service can help unlock value and customer satisfaction.



Research Centre at Karlstad University in Sweden, says this is happening because it is no longer enough to look at products and services in isolation.

"The goods and service divide is obsolete. Services have become the key to unlocking the value of physical goods," he explains.

Commoditization of goods means it is getting easier for rival suppliers to copy and imitate hardware. This makes it harder for suppliers to differentiate their products, encouraging them to look to service for new

ways to stand out from the crowd.

ALSO, COMMODITIZED HARDWARE is hitting the global market at a much lower cost than the goods produced by the traditional market leaders, weakening established business-to-business brands and putting manufacturing margins under pressure.

"Companies are coming to the conclusion that we have to look at the total relationship with the customer. Every touch point is an opportunity to differentiate, and we have to take those opportunities because it isn't

enough to focus solely on hardware anymore," says Peter Norrby, a Service Manager at Alfa Laval's Food & Water Division.

"Out of all the touch points you have with a customer, which is the farthest-reaching? It is service. Service is so fundamental. It's a way to ensure uptime for the customer, to reduce their lifecycle costs, and to ensure that they can meet their promises to their own customers. It is the opportunity to differentiate ourselves from competitors."

A HOST OF FACTORS are driving businesses to

extend their reach into service provision. Digitalization and the Internet of Things present unique opportunities to equip machines with sensors and other devices that can signal when a service is due or a problem may be about to occur.

Also, the growth of corporate social responsibility is pushing companies to take a lifecycle perspective in their purchasing, making them increasingly inclined to prefer alternatives that may cost more upfront but use fewer resources and are thus cheaper to run longer-term. Whereas the owners of some factories in fast-growing markets once had a short-term view of production, a longer-term perspective now sees more companies investing in quality and durability, which makes the need for service increasingly important.

Tony Shakib, a vice president at US data networking giant Cisco, says shifting to a service-oriented strategy “creates opportunities for value-added offerings that allow you to charge for business outcomes – such as performance or uptime – rather than physical assets”.

INCREASINGLY, LARGE COMPANIES are adopting such strategies. Healthcare company Siemens Healthineers of Germany charges its customers based on uptime. It uses sophisticated technology and advanced processes and workflows that connect real-time repair information, inventory management, pricing and invoicing with advanced logistics systems to give its service technicians the right data and parts where and when they need them.

In essence, the emergence of service reflects a new commercial mindset: that business is not so much about selling units and products as it is about helping the customer to be competitive in its business.

“A short-term gain by selling will not make a customer happy if the customer sits with a problem for ten years the customer will never come back. ‘Sell and run’ doesn’t exist anymore,” Alfa Laval’s Peter Norrby explains.

This is a big mental change – and one that can require a leap of imagination, and faith, from traditional capital goods companies.

Far-sighted corporations are embracing the new service mindset, and increasingly integrating service and sales to benefit their customers. As Bo Edvardsson says: “Services are resource enablers for systems that create value. Creating value is what service management is about – and we’re going to see a lot more of it.”

The future direction is clear: service is a fundamental lever for companies to set themselves apart from competitors and create customer value over time. Because what customer is not interested in more uptime, predictable maintenance costs, and peace of mind? ■



Selling peace of mind

Service Manager Peter Norrby says the mindset among Alfa Laval’s customers has changed from “don’t come to me and sell” to “come and help me keep my business running”.

“It’s about asking how we ensure maximum customer satisfaction over the lifetime of the equipment. It’s about going from reactive selling of spare parts to a proactive selling of peace of mind.”

Increasingly, Alfa Laval uses advanced software and sensors to monitor the condition of installed equipment. Knowing the right time to replace components is critical to plant productivity and uptime.

One of the world’s largest ethylene producers in Saudi Arabia discovered this when Alfa Laval recommended a condition audit for the company’s 11-year-old gasketed plate heat exchangers.

The heat exchangers had operated for many years without requiring maintenance and had delivered solid performance for so long that the customer saw no need for maintenance.

But, even if gaskets are specially selected for the purpose, they can last longer or need replacement earlier than expected depending on actual operating conditions.

In fact, the audit data clearly indicated that the gaskets were approaching the end of their service life and reconditioning the plates was necessary. Early action averted a high risk of plant shutdown.

THE TRUE COST OF DOWNTIME

Remotely monitoring equipment and fixing issues before they become full-blown problems is a highly attractive prospect for many companies. These two examples, which show what the cost of heat exchanger failure could be in two different applications, illustrate why:

USD 500,000 per day

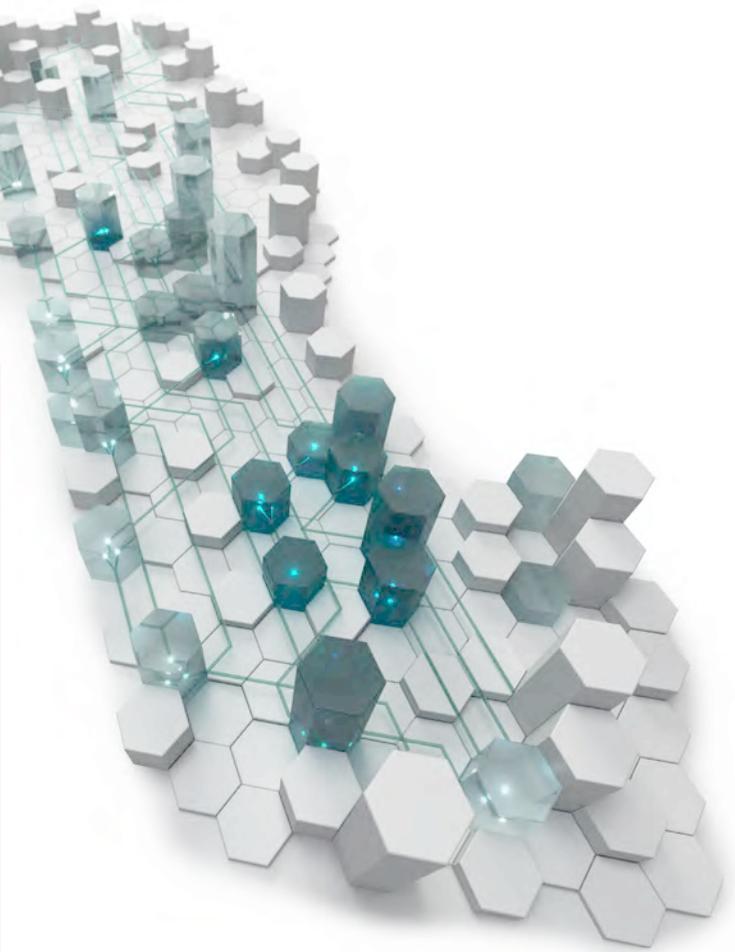
Production stop in a petrochemical application with plate heat exchangers in critical positions.

USD 30,000 per day

Production stop in a mid-size vegetable oil refinery where boiler failure leads to total stop at the plant.

“ A short-term gain by selling will not make a customer happy if the customer sits with a problem for ten years the customer will never come back. 'Sell and run' doesn't exist anymore”

PETER NORRBY, ALFA LAVAL.



How the internet is revolutionizing service

From advanced software to smart sensors and microchips, technology is transforming the ability of companies to provide high-value services to customers.

The Internet of Things – networks of data-gathering sensors that 'talk' to each other via the cloud – is a fundamental driver of this trend. By allowing a manufacturer to stay close to the customer over the full product lifecycle, it gives the customer peace of mind.

Digitalization allows manufacturers to allocate their resources better and to transition from reactive maintenance and proactive maintenance (doing minor services at regular intervals) to predictive or needs-based maintenance, whereby technicians monitor machinery remotely and can respond instantly to increased vibration, heat or other problems.

Thanks to this technology, parts can be changed before they fail or trigger a breakdown. This enhances uptime and increases production reliability – a vital asset for any customer.

WASTE OIL RECOVERY

STEPPE



CHANGE

The rugged beauty of the vast expanses of western Kazakhstan is scarred by the ugly black blemishes of waste oil. But by using centrifuges to separate the waste into water, solids and marketable crude, a local entrepreneur hopes to clean up – financially and environmentally.

TEXT: **RICHARD ORANGE** PHOTOS: **EMIL MALMBORG**

Kazakh waste oil entrepreneur Bauyrzhan Zhanybekov gestures down from the desert cliff over the patchwork strip of black and shimmering blue more than 120 metres below, the yellow Mars-like steppe landscape of Kazakhstan's Mangystau province stretching out beyond.

"My first impression when I saw this fifteen years ago was how beautiful it was", he says. "The nature is amazing. I was shocked at how it had been polluted."

The lake — 8km long, 1.5km wide, and filled with sticky black tar — is the most extreme example of the pollution that has built up around the desert town of Zhanaozen since the supergiant Uzen field was discovered here more than half a century ago.

It was formed in the 1970s, when an accident ruptured a pipeline

carrying close to 500,000 barrels of oil and engineers diverted the flow — perhaps only for a few months — while they carried out repairs. The tar has been trapping birds and animals ever since.

Zhanybekov wants to finally clean up the mess.

THE KAZAKH GOVERNMENT is set to issue a tender to clean up both the lake and the historic slop oil lagoons that dot the surrounding countryside, and EcoOrientir the oil service company Zhanybekov co-founded doesn't intend to ask for a single tenge (the currency in Kazakhstan) in payment, instead aiming to profit from selling the recovered oil.

If his plan works, he hopes to restore the landscape he loves, recover huge volumes of valuable oil, and make a profit, all at the same time. "There is competition," he concedes. "But we have every chance to take all these volumes, because no one in this area has such a plant." 

WASTE OIL RECOVERY



The 8km-long lake of sticky black tar has been trapping birds and animals since the 1970s, when an accident ruptured a pipeline.

Zhanybekov and his partners bought a run-down waste oil treatment facility in spring 2014, when the oil price was above \$100 a barrel, making even waste oil very valuable.

With 30bn barrels of proven oil reserves, Kazakhstan ranks twelfth among the world's oil nations, just behind Nigeria. But its environmental regulations have lagged behind, allowing oil exploration and production companies, pipeline operators and refineries to dump their slop oil in lagoons.

After the lake, Zhanybekov takes us to some of the biggest legacy lagoons, tucked behind a set of towering oil storage tanks in the dusty town.

He knew about these lagoons from his years working for the national pipeline company, which owns the site, so when the government started tightening the rules about five years ago, he saw an opportunity.

The petroleum fumes here are strong enough to make your eyes water, but Zhanybekov dismisses any suggestion that the strong evidence of oil in the air means automatic profits.

GETTING THIS business going has been anything but simple. Within months of buying the plant, Zhanybekov, who serves as chief executive, realised that the old tanks on site were only capable of bringing the water level in treated oil down to about seven percent – well below the one to two percent maximum for marketable crude.

So he approached three companies – Alfa Laval among them – for a new separator for

the sedimentation tank. Of the two other companies, the first had no local office and the second wanted only to rent equipment. Only Alfa Laval came back with a detailed, technical solution. But, instead of a separator, Alfa Laval's Central Asia representatives Marina Mikhailovskaya and Dmitry Zhloba recommended an alternative technology: decanter centrifuges.

"We realized we could not only improve the quality, but increase the capacity many, many times," Zhanybekov says.

In a blue metal shed at EcoOrientir's site, strategically located just 5km away from the oil lake, sit two newly installed Alfa Laval Lynx 430 three-phase decanter centrifuges, in complete parallel lines, along with a polymer preparing station, two dosing lines, mixers, feed pumps, heaters, a tank for cleaned crude oil, and a screw conveyor for solids.

THE DECANter centrifuges separate oil waste into water, solids and marketable crude, by producing a centrifugal force of up to 3,500G. This means that, despite being only five metres long and a little over a metre in both height and width, EcoOrientir can now process waste oil at a rate of 360 cubic metres a day – enough to fill an Olympic swimming pool every week. Each centrifuge has up to 3,500 times the capacity of a sedimentation tank the same size.

The decanters are designed to handle coarse particles and

take large quantities of solids – perfect for EcoOrientir's mixed quality feed. For the test run in April, the company's engineers fed in what they call "the waste of the waste", scraped from the bottom of their own sedimentation tanks. The plant produced marketable crude from this nonetheless.

It has certainly not been easy. By February, when EcoOrientir was installing the new equipment, the oil price had fallen below \$30, rendering the plant potentially loss-making. It took four months before the price rebounded to \$50, making the project profitable again.

Integrating the controls and fire protection systems on site with Alfa Laval's new equipment has been challenging, requiring Alfa Laval's engineering centre in Russia to work closely with EcoOrientir from the first design drawings.

SEARING SUMMER temperatures make excavating slop oil ponds impossible during the day, as the oil becomes too liquid, so



A tough machine for a tough environment



“ We realized we could not only improve the quality, but increase the capacity many, many times.”

BAUYRZHAN ZHANYBEKOV
WASTE OIL ENTREPRENEUR

work must be done either at night or in the winter.

What Zhanybekov has is first-mover advantage the only other oil service company that can process slop oil is a 900km drive away in Atyrau.

This is why he thinks that his company has by far the best chance of winning the government contract. But even if he doesn't, he is confident he will have enough work.

“There are a lot of other private lagoons and lakes that need to be treated.”

EcoOrientir now plans to buy trucks and excavators to collect waste direct from customers and renovate the on site refinery to produce fuel oil.

Alfa Laval has also helped the company dispose of the five tonnes of solid residue produced for every 100 tonnes of waste oil treated by connecting it to the CaspiCement factory 140km away. CaspiCement has now carried out tests on this 'cake', and may use it to replace coal. There is also space for two more Alfa Laval decanter centrifuges to extend the plant in future.

“We are going to start in this region,” Mr Zhanybekov says. “Then, if the business works, we will do it elsewhere.” ■



Alfa Laval's LYNX decanter centrifuges are the most hard-wearing available, with replaceable parts made out of tungsten carbide. The bowl, conveyor and casing are made from the same steel used for nuclear reprocessing, and there is also the option of an extra coating of wear protection for use with extra-harsh and abrasive feeds.

The decanter is built around a slender cylindrical bowl, which rotates at speeds of up to 3650rpm to produce a centrifugal force of up to 3574G. The decanter is 5.23m long, 1.325m in height and 1.190m wide, and can take about 500kg of waste oil, with a maximum flow rate of

100m³ per hour.

Slop oil or drilling mud is first treated with a flocculant to bind the finer particles together, and it is then fed into the bowl, where the centrifugal force presses it outwards to form a layer – known as the pond – around the wall.

Since the solids in the mud are heavier, they remain plastered against the bowl wall, where they are continuously removed by a screw conveyor, and then deposited outside the building.

The treated oil collects in the centre, exiting at the wide end of the decanter. The water is removed from discharge weirs at the end of the cylindrical section.

A brief history of oil in Kazakhstan

1717: Prince Alexander Bekovich-Cherkassky documents oil near Atyrau, months before he is executed by the Khan of Khiva.

1899: Well drilled at Karashungul by the St Petersburg-based Emba-Caspiy strikes oil.

1910: Emba-Caspiy lists in London as Ural-Caspian Oil.

1911: Ural-Caspian makes major find at Dossol. Bought out by Royal Dutch Shell.

1917–1920: Russian revolution and civil war. Oil regions not brought under Soviet control until February 1920.

1961: Discovery of the supergiant Uzen field renews Soviet interest.

1979: Discovery of the 6bn barrel Tengiz field.

1993: Independent Kazakhstan signs deal with Chevron to develop Tengiz.

1993: Kazakhstan signs deal with Shell, Statoil, Mobil, BP, Total and Agip to explore northern Caspian.

2000: Discovery of the giant Kashagan offshore field.

2013: Kashagan begins production, but produces for less than a month before it is shut down due to pipeline cracks leaking deadly hydrogen sulphide gas.

2016: Kashagan to restart production?



Saving Venice

One of the world's most iconic cities is under threat from rising seawater. With climate change fuelling the sense of urgency, engineers are constructing the world's most advanced flood barrier on the floor of the Venice lagoon. Its ingenuity? When not in operation, you wouldn't even know this €5.5bn construction was there.

TEXT: **CLAUDIA B. FLISI** PHOTOS: **MAURIZIO CAMAGNA**



HYDRAULIC COOLING



The year 1966 was a wake-up call for the city of Venice. Until then, centuries of intermittent acqua alta (high water) had been an annoyance in the winter months, but not a major threat. Every three years or so, a combination of high tide and weather conditions resulted in water on some city streets that lasted for a few hours; rubber boots and raised platforms handled the problem.

BUT THE FLOODS of 1966 brought two metres of water into Venice, causing millions of dollars in damage and destroying priceless artwork. Over the next 40 years, climate change, rising sea levels, and a sinking city have increased the frequency of acqua alta and brought urgency to the need for a solution. “We can’t predict the future, but we know things have become verifiably worse in recent years,” notes local architect Monica Ambrosini.

She is a spokesperson for Consorzio Venezia Nuova the consortium entrusted by the Italian government to save Venice from the sea. That solution is Mose, an innovative flood barrier project designed to control the high tides threatening the city. The name alludes to the biblical leader who is said to have parted the Red Sea, and stands for MODulo Sperimentale Elettromeccanico, or Experimental Electromechanical Module.

Mose is a system of 78 mobile gates placed at the three openings of the barrier island separating the Venice lagoon from the Adriatic. Under normal circumstances, they will lie flat under the water in boxy struc-

tures, or caissons. When needed (an estimated four or five times a year), they will be raised to prevent rising sea levels from entering the lagoon. When the high tide has subsided, they will be lowered again.

THIS IS THE key to Mose’s ingenuity. Unlike water control systems in Rotterdam, London, and a number of Japanese cities, Mose does not have permanently visible pillars. One of the design requirements was for it to blend in with the city it defends, and this called for a system as unique as Venice itself.

When the go-ahead for construction was first given in 2003, Mose was “the most innovative system of its kind,” says Ambrosini, and “it still is. It is very flexible at all tide levels. Its operation is quiet. It is respectful of marine life and the environment.”



Monica Ambrosini: ‘Things have become verifiably worse in recent years.’

ENVIRONMENTAL CONCERNS ARE a top priority because of the city’s World Heritage status and because of the 23 million tourists who visit Venice each year. Increasing numbers of them come on mammoth cruise ships, so Mose had to accommodate these cruise vessels, and oil tankers as well.

The technical challenges of the project have been compounded by its size and

“Its operation is quiet.
It is respectful of marine
life and the environment.”

MONICA AMBROSINI,
CONSORZIO VENEZIA NUOVA

MOSE: PROJECT IN FIGURES

- **1 lock for big ships** (at Malamocco)
- **2 refuge harbours** (at Lido and Chioggia)
- **3 metre-high tide** can be withstood
- **4 mobile barriers**
- **15 minutes** average time to close (lower) the barriers
- **30 minutes** to open (raise) the barriers
- **78 mobile** barriers in total
- **1,000 workers** involved
- **2018** estimated year of completion
- **€5.5bn** estimated total cost (as of March 2016)

DAM IT: some other notable flood barriers



■ The Oosterscheldekering (The Netherlands)

The 9km-long Oosterscheldekering is the largest surge barrier in the world, and is just one of 13 dams and storm surge barriers in the Delta Work project in the Netherlands. The Oosterscheldekering consists of a large number of doors located at sea level that regulate the amount of water flowing in from the North Sea. The dam has only been fully closed 25 times since it was officially opened in 1986.



■ Thames Barrier (United Kingdom)

The Thames Barrier is the world's second largest movable flood barrier and, since completion in 1982, it has protected London from being flooded by exceptionally high tides and storm surges moving up from the North Sea. It consists of rotating gates that, when open, lie horizontally on the bottom of the Thames and, when closed, rotate into a vertical position. As of 2016, it had been closed 176 times.



■ Saint Petersburg Dam (Russia)

In 1978, the Soviet Union started the construction of the Saint Petersburg Dam, but the 25km-long complex of dams was not completed until 2011. It consists of 11 dams and two water locks that separate the Gulf of Finland from Neva Bay in order to protect the city from coastal flooding. The heart of the Saint Petersburg dam is the southern water-lock and its two floating radial steel gates that swing in to meet in the middle.

HYDRAULIC COOLING

complexity. Engineer Tomaso Gastaldi works for Comar Scarl a company performing contracting services for Mose overseeing the work of 50 or more companies, including four major enterprises. “The problem with any large project is coordination of a large number of suppliers and companies,” he says. “You have to integrate different deadlines and coordinate the activities of many companies. Each company has its own interest and know-how, and not all are collaborative in the same way. This is the major issue we deal with.”

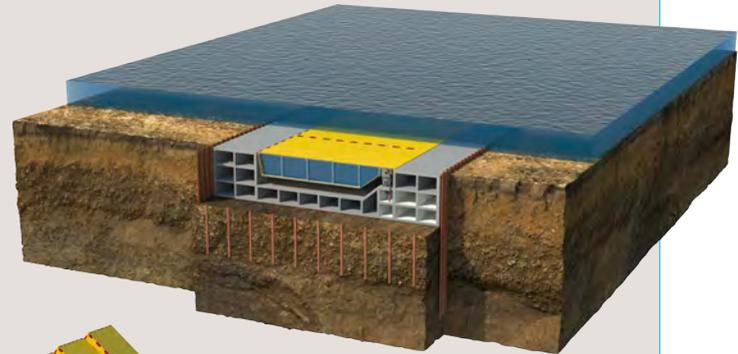
IN ADDITION, MOSE has been embroiled in political scandal and its deadlines have been delayed several times by corruption charges.

The juicy headlines have obscured the project’s solid accomplishments, according to Gastaldi and Ambrosini. First and foremost, Mose will protect Venice from up to three metres of acqua alta, and it will do so in a way that is sensitive to its environment. Second, its unique technology will encourage the development of engineering innovations – civil, mechanical, and marine. Plus, if in the future it is decided that Mose should be dismantled, this can be done without permanent damage.

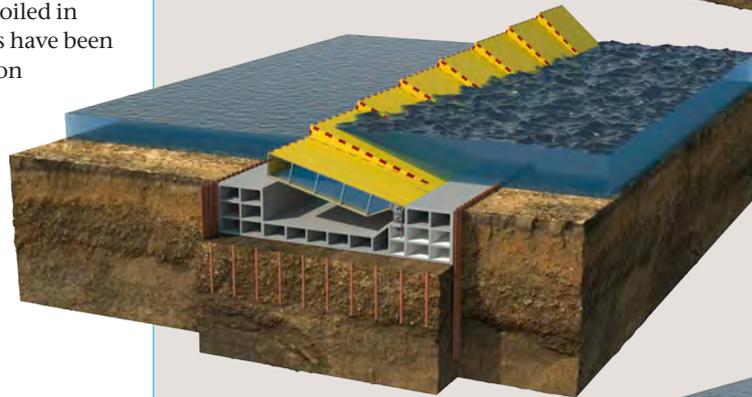
One of Mose’s barriers has been operating in test mode since May 26, 2016, and the technical performance has been more than satisfactory. All 78 gates will be officially operational in June 2018. ■

HOW IT WORKS

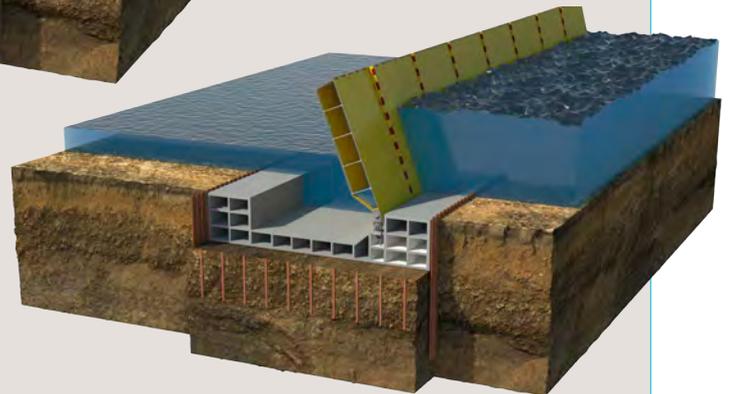
1 The Mose mobile gates are normally full of water, resting out of sight in their housing structure on the seabed.



2 When tides rise by more than 110 centimetres, compressed air is introduced into the gates, emptying them of water so that they start to rise.



3 The gates rise above the surface until they separate the lagoon from the sea. When the tide drops again, the process reverses and the gates return to their housing.



Compact, quiet and energy efficient:

Alfa Laval’s cooling solution

When flooding conditions occur, Mose’s 78 mobile gates are pumped with compressed cooled air from Alfa Laval heat exchangers. This air forces out the seawater that normally fills the gates – and keeps them submerged – and they rise from their caissons under the lagoon to become barriers against rising sea levels. The air has to be cooled first because the mobile gates are made of a rigid composite material that cannot tolerate air at too high a temperature, explains Paolo Zapparoli, Product Manager, Industrial Dry Coolers, at Alfa Laval

in Alonte, Italy.

Two models of Alfa Laval air heat exchangers are being used in the Mose project.

From the same Alfa V product family – they differ only in size and their heat transfer capability – they were chosen for their compact layout, low noise level, and energy efficiency, says Zapparoli.

He adds that another important element in this project’s success was the collaboration between Mose engineers and Alfa Laval



specialists: “We worked together from the start to adapt our standard models to their specific requirements, suggesting improvements in terms of materials and new technologies.”

These modifications included thermic material, a new interface, decreased sound levels thanks to new ventilation, adjusted mechanics, an improved layout, lowered electrical consumption, reduced footprint, and compressors with high power and low volume.

The underlying reason for the

modifications was that several years had passed since the first discussions of the project to the actual realisation, and during this time technology had not stood still. Zapparoli is very proud of this aspect of the collaboration – that Alfa Laval had taken the initiative to incorporate newer technologies, even though the brief had been based on older ones.

The system has been tested successfully in a pilot project on site. Project engineers have made a few technical adjustments to improve the automation of the barriers, but the components have performed impeccably.

A CERAMIC REVOLUTION FOR HEAT EXCHANGERS

Cutting-edge research at Alfa Laval's labs using new non-stick technology leads to vastly improved uptime and reduced maintenance costs for heat exchangers in the oil industry.

TEXT: **RICHARD ORANGE** PHOTOS: **ALFA LAVAL**

If you've bought non-stick frying pans over the past decade, you may have noticed a point at which the Teflon coats that scratched and filled your food with flecks have been replaced by ceramic ones that last longer.

These new non-stick coatings are the result of sol-gel technology a process from colloidal chemistry whereby silicon is evenly distributed with organic components in a liquid that becomes a hard, durable solid when heated.

"It's a very thin, flexible, ceramic coating that is applied by spraying and then cured," says Clemens Wictor, the concept design and project manager working on the project launched by Alfa Laval to commercialize sol-gel coatings developed by a leading Scandinavian technological institute.

IN 2016, THE first fruits of the collaboration came to market in the form of the Alfa Laval Antifouling Coating for crude oil coolers, which was based on a sol-gel ceramic called Core Coat 010. The coating, which can be as little as a thousandth of a millimetre thin, more than triples the time heat exchangers on oil platforms can operate before they need to be shipped ashore for servicing. The

coating also reduces costly production stops due to fouling.

Before crude oil is shipped from offshore platforms, engineers first stabilize it by heating it up to around 100°C to reduce the water content and remove dangerous gases. They then cool it using heat exchangers made of thin titanium plates, such as those made by Alfa Laval.

The problem with this process is that wax and crystalline substances that reduce thermoconductivity very quickly form crusts on the plates. This creates a pressure drop that eventually stops them working. Every eight months, they need to be shipped to shore, dismantled to

remove the gaskets, and dropped in a bath of caustic sodium hydroxide – a process that can cost tens of thousands of euro for each heat exchanger, depending on the number of plates.

Coating heat exchangers with Core Coat 010 means they only need to be cleaned after two to three years, and the cleaning itself is much simpler. It can be done by simply spraying them down with a high-pressure water jet, without needing to even replace the gaskets.

For Core Coat 010 to work, the water content in the crude oil being treated has to be below 10 percent, while the temperature needs to be below 80°C.

HOW IT WORKS

Alfa Laval Antifouling Coating is based on colloidal chemistry, which contributes to extremely stable systems where one material is evenly distributed in another material. A silicone component in the coating makes the surface hydrophobic. This drastically increases the contact angle and reduces the surface energy, and thereby reduces adhesion to plate contact points.

WICTOR AND HIS team at Alfa Laval's Material and Chemistry Centre (MACC) in Lund, Sweden, are now field-testing a new coating for the heating stage of crude stabilization, which, while still flexible, can withstand higher temperatures and a higher percentage of water.

Alfa Laval is also working with the institute on coatings to prevent seaweed and other life forms from sticking to equipment cooled with sea and river water, and even coatings to prevent limescale on boilers and kettles.

Now that might be as welcome as a durable non-stick pan.

OCEANS APART

AN ALASKAN FISHING COMPANY'S QUEST FOR SUSTAINABLE SEAFOOD

Beneath snowy peaks and azure skies, a fishing trawler cuts slowly through the icy waters of the Bering Sea. Returning to port in a sheltered bay, the vessel is laden with delicacies ready to be processed, packaged and shipped to markets worldwide. As part of that processing, an Alfa Laval technology has been brought in to help create value from waste, cut energy costs and meet regulations aimed at reducing the impact on this pristine environment.

TEXT: GREG MCIVOR PHOTOS: GETTY, ALFA LAVAL

The backdrop to this picture-postcard scene is Dutch Harbor a small community in Alaska's Aleutian islands that is home to Westward Seafoods. The company's processing plant here produces 127,000 tonnes of fish and seafood a year mainly Alaskan pollock but also halibut, cod and black cod, as well as king, snow and Dungeness crabs.

Westward Seafoods is an industry giant. Part of Japan's Maruha Nichiro. The company is also an industry leader in sustainable fishery practices.

It has a long track record of striving to be environmentally responsible and operating a sustainable fishery. Westward Seafoods is closely involved with the Marine Stewardship Council, which is an independent global organization committed to preserving the health of the world's oceans.

Dedicated to minimizing its eco-footprint, Westward Seafoods works to stay ahead of the curve in an industry where waste and pollution are subject to increasingly tight

regulation by the US Environmental Protection Agency. For the company, these efforts are a win-win.

One area where the company is focusing its attention is a factory by-product known as 'stick water'. This is a liquid mix of water and suspended fish oil and residues that is left over from seafood processing at the company's Westward Seafoods' plant in Dutch Harbor, as well as the nearby Alyeska plant, which is also owned by Maruha Nichiro.

Traditionally, seafood producers have used decanters and high-speed concentrators to treat stick water. But, despite their best efforts, a significant amount of oil typically remains in the effluent.

A FEW YEARS AGO, Alyeska and Westward Seafoods approached Alfa Laval for advice on how to clean their stick water. Together, the two plants produce around 10,000 gallons of stick water per hour.

The idea was to protect the environment while generating additional revenue, because fish oil is a



“It’s a real win-win, especially when you consider that producers simply used to release this wastewater into the sea.”

IAN CLARKE, ALFA LAVAL REGIONAL SALES MANAGER

precious resource with multiple uses, ranging from fishmeal additive to omega-3 fatty acid supplement.

Fish oil can also be used as an alternative to diesel. When Westward Seafoods decided to refine its stick water stream, fish oil at the time had a market price of US\$4.65 a gallon – the same as diesel.

TYPICALLY, STICK WATER contains as much as 1 to 2 percent fish oil. Using technology that can reduce this oil content to 0.5 percent, recovering the remainder to either sell or use as a diesel oil substitute, Westward Seafoods can raise extra revenue and cut its energy costs at the same time.

“For many years, we have been losing valuable fish oil – between 1 and 1.5 percent,” explains Ricardo Solis, Westward Seafoods’ Meal Plant Manager. This equates to up to 40 gallons per hour.

He adds: “While we were using polisher and oil separators, these were not designed to completely remove 100 percent of the oil from stick water.”

WESTWARD SEAFOODS was using decanters that send the water and oil phases to high-speed concentrators. The oil phase of the concentrator then goes to a purifier.

In both steps, some oil exits both the concentrator and the purifier in its water discharge.

Westward Seafoods wanted an innovative technology that could remove the oil along with unwanted suspended solids. It chose an Alfa Laval skimmer, which is specially optimized to capture oil.

The skimmer, sometimes used in broth applications, is essentially a centrifuge with a special internal configuration and an ancillary system. The system has now helped Westward Seafoods achieve its aim of reducing the oil content in its stick water to less than 0.5 percent from 1 to 1.5 percent.

The first skimmer was installed in 2014, and a second immediately afterwards. Westward Seafoods has plants in production round-the-clock during the fishing



SUSTAINABLE FISH PROCESSING



Waste and pollution from the fishing industry are subject to ever-tighter regulation from the Environmental Protection Agency.

➤ season, and expects to break even on each skimmer in about 18 months.

THE RAPID PAYBACK mirrors the results from the process. “Westward are very proactive, they’re keen to stay ahead of the curve and everyone is delighted with the results so far,” says Ian Clarke, Alfa Laval Regional Sales Manager.

“It’s a real win-win, especially when you consider that, in the past, producers simply used to release this wastewater into the sea. Alfa Laval is helping Westward Seafoods to meet new, stricter environmental standards while capturing a valuable product.”

Currently, Alfa Laval and Westward Seafoods are continuing their partnership with the aim of increasing efficiency and reducing environmental footprint.

That would be even better news for the environment, open a lucrative new market for Westward Seafood, and help prove the adage that less really can be more. ■



From left: Alfa Laval’s Ian Clarke and Tommy Kristensen together with Ricardo Solis from Westward Seafoods.



The Alfa Laval skimmer allows Westward Seafoods to reduce oil content in its stick water to less than 0.5%.

DRIVING MARINE DEVELOPMENT THROUGH TESTING

The use of gas and other non-diesel fuels is on the rise at sea. Liquid natural gas (LNG) tankers are at the forefront of this trend, quite simply because it makes sense to be propelled by the cargo on board. This poses new challenges and increases the focus on LNG as a fuel and as cargo. And that in turn places new demands on gas combustion technology. At the Alfa Laval Test & Training Centre in Aalborg, Denmark, development and testing are underway into the solutions that the marine industry will increasingly require.

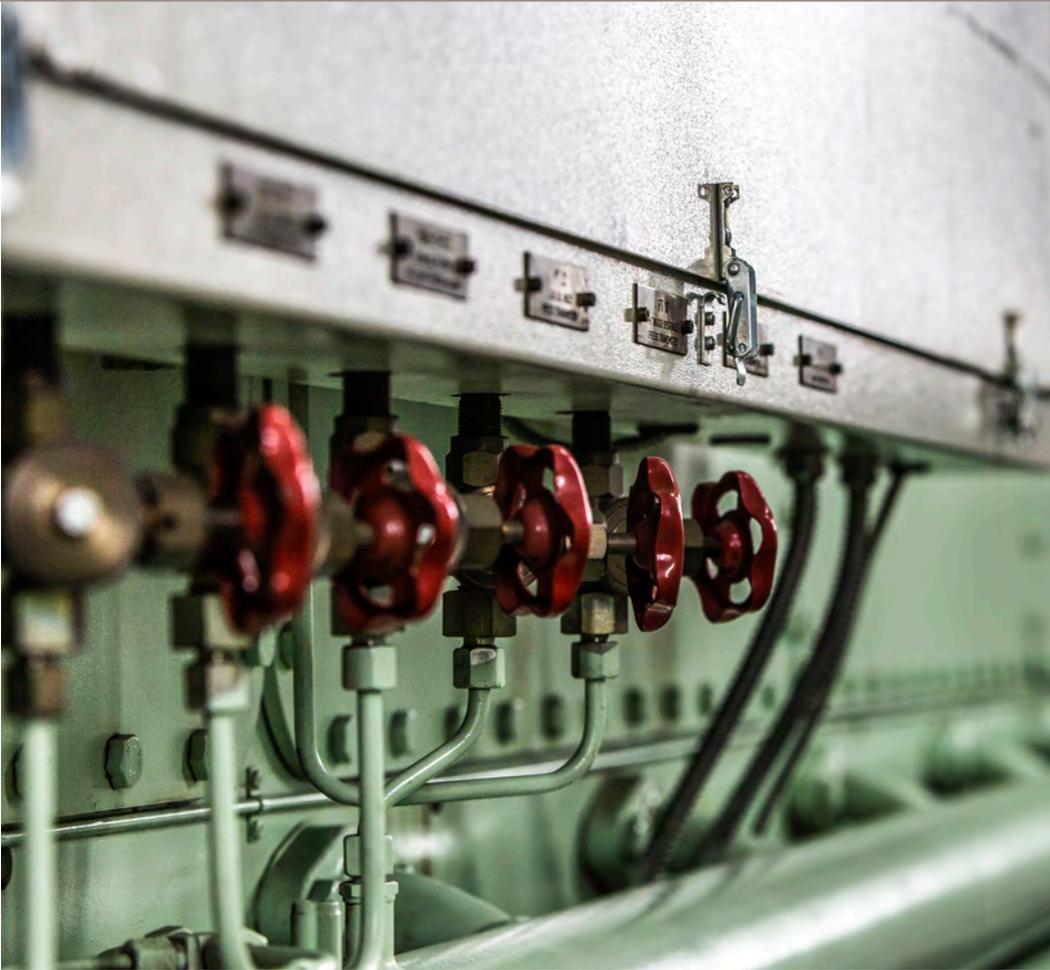
TEXT: PETER GODDARD PHOTO: JOHNY KRISTENSEN



“This is a hands-on place where we cooperate to develop solutions that will bring the shipping industry forward.”

LARS SKYTTE JØRGENSEN,
VICE PRESIDENT PRODUCT CENTRE
BOILERS, ALFA LVAL





Alternatives to marine oil

The shipping industry is currently dominated by the use of marine oils, mainly heavy fuel oil (HFO) and marine gas oil (MGO). According to Lloyds Registry, the share of HFO will be as low as 40% by 2030, due to environmental concerns.

Liquefied natural gas (LNG) represents the most viable alternative fuel to HFO for ships. LNG is an attractive, alternative because it reduces NO_x by 85-90% and virtually eliminates SO_x. By 2030, it is expected that 7,000 vessels will be sailing with LNG, compared with a mere 500 in 2015.

Marine engine manufacturers offer dual or triple fuel engines that can be operated with the above-mentioned fuel options. A number of other liquid fuels can be used in these engines, namely liquefied petroleum gas (LPG – a mixture of propane and butane), methanol, ethanol, and di-methyl ether (DME).

Gas is seen as one of the answers to future fuel needs as an alternative to oil, coal or nuclear power. Today natural gas accounts for around a quarter of global energy demand, of which around 10% is supplied in the form of LNG – compared to just 4% in 1990. To meet this developing need for gas there is a growing fleet of LNG carriers plying the oceans; there were 99 vessels in 1997, while by 2030 there are expected to be as many as 7,000.

At the same time increasingly stringent legislation on emissions enacted globally by the International Maritime Organization, as well as regional and national bodies, is putting new environmental demands on the shipping industry and driving interest for new technical solutions, and particularly around LNG. But the introduction of alternative energy sources takes place at a very slow pace because it takes time for technologies to mature and for the necessary production and distribution infrastructure to be built.

What is the best way to design new LNG carriers given that the gas on board can be

used to propel the ship? One standard approach is to have a propulsion system of a dual type capable of using either diesel oil or the gas vapours coming from the cargo tanks. Another approach is to have a triple type for using heavy fuel oil, diesel oil as well as gas. Emissions of NO_x (nitrogen

oxides) can be cut by 80% or more, and SO_x (sulphur dioxide) emissions can be eliminated by the use of sulphur-free gas in comparison to heavy fuel oil. Apart from environmental and efficiency gains, the amount of boil-off gas and the pressure in the tanks can be regulated by burning the gas in the

A unique testing facility

- The Alfa Laval Test and Training Centre is located in a construction hall of the former shipyard at Aalborg in Denmark. The equipment is steered from a dedicated control room and can also be steered remotely.
- Phase 1: Inaugurated in 2014. 250 m² testing space under actual operating conditions using a 2 MW marine diesel engine. Features major process lines: fuel line, steam line, exhaust gas line and ballast line.
- Phase 2: Construction began in May 2016. Testing began on full-scale GCU in September 2016. Combustion technology testing will commence in February 2017.
- Lifting capacity of cranes: 2x23 tonnes to a height of 12m.
- Major research collaborations: Aalborg University, Technical University of Denmark in Lyngby, and RWTH Aachen University in Germany, and marine engineering colleges in Denmark and Norway.

A natural fuel choice for LNG carriers

LNG carriers are usually fuelled in part by the natural gas they carry, as well as conventional marine gas oils (MGO).

The liquefied gas is transported at a temperature of -160°C in insulated tanks.

Inevitably, some of the gas kept in these cryogenic conditions evaporates and it can be redirected to fuel the engine. Any excess gas not burnt in the engine must be vented off and burnt in a combustion chamber under safe and controlled conditions.

A gas combustion unit must meet a challenging set of specifications. A unit designed for the largest of the Very Large Gas Carrier class has to be capable of burning off 4.5 tonnes of gas per hour (equivalent to 60 MW) at the drop of a hat in an emergency.

The temperature at the gas burner is around $1,400^{\circ}\text{C}$ but by the time the exhaust leaves the stack, safety regulations state that the temperature must be down to 535°C . This is below the self-ignition temperature of natural gas in case of gas leaks. To achieve this rapid cooling, vast amounts of air are carefully blown into the combustion chamber on the GCU.



The Test and Training Centre features a full-scale gas combustion unit for simulating the largest units needed at sea.

engine as fuel. However, there are times when the main engines are not running, such as in harbour. Then the boil-off gas can build up and may need to be burnt off rapidly.

Vaporized gas is a huge safety issue on board LNG carriers. Emissions of the gas are a major environmental hazard, but Alfa Laval's Gas Combustion Unit (GCU) is an essential piece of safety equipment that secures that the gas is burned in a safe, controlled manner, securing minimum impact on the environment. This is done by burning the boil-off gas instead of releasing it into the atmosphere.

"As gas and multifuels grow, the demands on combustion technology and systems become more complex," says Lars Skytte Jørgensen, Vice President Product Centre Boilers. "This then drives demand for R&D and testing

around these technologies to ensure reliability, safety and ease of operation."

Alfa Laval has a unique testing and training centre located in the former Aalborg shipyard in Denmark. The country has a long and proud history as a seafaring nation – from the Vikings to Maersk, the world's largest container ship operator – and the city of Aalborg is home to world-leading competence in the marine industry. This is the main site where Alfa Laval Industries was based when Alfa Laval acquired the company in 2011. Aalborg Industries has built ships since 1912 and boilers since 1919.

It was in Aalborg in 2015 that Alfa Laval tested its new generation of Alfa Laval PureSOx in-line scrubbers for exhaust gas cleaning. The next generation of waste heat recovery boilers was tested here in summer 2016.

The first phase of the Alfa Test & Training Centre, covering 250m² of the hall, was opened in 2014. It is a unique centre that can be likened to a functioning commercial vessel on land (see article on next page).

In January 2017 – exactly a century since Alfa Laval sold its first separator to the marine industry – Phase 2 was completed, representing a five-fold expansion of the testing and training area. The prime purpose of Phase 2 is to develop modern combustion technologies for multi fuels such as gas. These developments are expected to boost energy savings and support low emission technology.

Already a full-scale working gas combustion unit has been constructed here to simulate the largest units currently needed at sea. The reasoning is that it is easier to scale down the results from this large unit



The Alfa Laval FCM one. "If you are unsure about purchasing a new product we say 'come here and we'll show you how it works'."

PUTTING NEW MARINE TECHNOLOGY THROUGH ITS PACES – ON DRY LAND

Testing new marine technology at sea is fraught with difficulties and constraints. But Alfa Laval's Test and Training Centre at Aalborg, Denmark, allows for running equipment in conditions similar to those at sea – without ever leaving dry land.

When Alfa Laval in Monza, Italy, developed a new type of fuel conditioning module (FCM) for marine applications, it was transported to Alfa Laval's Test and Training Centre in Aalborg for full-scale testing under conditions similar to those on board a ship.

The hub of the test site is a fully operational marine engine capable of generating 2MW of power, making the test and training centre the closest thing on land to the machine room of a full-sized commercial vessel.

One mode for the test engine is diesel or marine gas oil (MGO) and the other mode is heavy fuel oil (HFO). Sometimes, customers mix these two fuels to make a cheaper blend and comply with environmental legislation. The idea of the trial in Aalborg was to demonstrate to a potential customer that the FCM could mix the fuels in the right proportions to comply with the relevant emission regulations. The emissions were carefully measured and the trials convinced the customer that the module could deliver the low levels of SOx required in a reliable way.

Working with the defined fuels and a given sulphur target, the Alfa Laval FCM One can calculate the ideal blend and then mix the fuels accordingly. The first customer was already prepared to put in an order but was also keen to know how the new module worked in reality, as there was no reference list.

"We cleaned out the tanks here and purchased the same oils as the customer would have on the ship," says Kenneth Christensen. "Then we ran the engine so the customer could see the fuel conditions."

"With a test centre, you can really get closer to customers and show them that these are the alternatives. The customers are given the numbers for their particular vessel and can do the maths themselves," says Lars Skytte Jørgensen, Vice President Marine and Diesel Division. "In this case, we could first show that our equipment was reliable on marine gas and diesel. Secondly, we showed the same with heavy fuel oil. Then the third condition was to mix those two, put it through an engine and measure the content of the exhaust fumes. We could show that our module was capable of mastering all three conditions."

The product was a prototype that had never been used on the market before. "If you are a customer and you are faced with a completely new product, you are a little bit unsure about purchasing it. So we say: 'come here and we will show you how it works,'" says Christensen.



Lars Skytte Jørgensen, left, in discussion with Test Centre Manager Kenneth Christensen. As gas and multifuels grow, the demands on combustion technology and systems become more complex.

than to scale up from a smaller unit.

The next step will be a combustion chamber for development of combustion technology, followed by an optimization of the boiler design to enhance and verify energy efficiency and environmental impact.

"Testing is important, but the ability to operate and optimize systems is vital for performance of the equipment on board," says Kenneth Christensen, Test Centre Manager. "The centre is used to train engineers to do just that. It also acts a showroom for Alfa Laval's equipment. On one day, the centre may receive a delegation from a tank fleet operator in China and on the next day, a group from a major ship-builder in South Korea."

"For me, it was an eye-opener that more than 1,500 people from outside Alfa Laval have come here since we opened. It attracts customers, universities, component producers, shipyards, ship-owners and ship designers," says Lars Skytte. "This is a hands-on place where we cooperate to develop solutions that will bring the shipping industry forward." ■

China says yes to yoghurt

The fact that the vast majority of its population of 1.35bn people are lactose intolerant means that the Chinese dairy market has historically been relatively small. So why has yoghurt taken off?

TEXT CHRISTOPHER HORTON PHOTO GETTY

Despite its thousands of years of civilization and its highly developed cuisine, dairy products have been almost completely absent from Chinese tables until the last couple of decades. Other than the traditions of the nomadic and pastoral populations around Mongolia and

Tibet, the idea of using milk in food was as un-Chinese as one could get.

One reason is simply the fact that the vast majority of Chinese are lactose intolerant, meaning they cannot digest lactose – milk sugar – and so most avoid dairy products.

But tastes and habits change over time, and over the past three decades of China’s reform and opening period, a massive market has emerged for dairy products, and yoghurt in particular.

According to data from Euromonitor, China’s yoghurt industry is already valued at more than \$10 billion. And researchers expect yoghurt to continue to grow faster than any other dairy category in the short-term, increasing in value at a compound annual growth rate of 14 percent. With this will come more investment in production. One of China’s largest dairy producers, Bright Dairy, recently invested CNY1.2 billion (\$179 million) in a dairy factory in Wuhan to produce Zhiwu Huoli pre/probiotic drinking yoghurt. The factory’s 64 production lines are projected to produce 360,000 tonnes annually.

What then is fuelling China’s growing thirst for yoghurt?

Andrei Soroka, Marketing, Category and Portfolio Director, Greater China, South Asia, East Asia and Oceania at Tetra Pak, puts it down to a shift in consumer preferences driven by health concerns.

“Consumers have changed from drinking low-quality products to drinking products that can enhance their lifestyle or improve their health,” Soroka says. “With more

disposable income, people began to ask themselves: ‘Can I afford to drink something better?’” He adds that premium Western brands, including Yoplait and Danone have benefited from this change in thinking.

Even though China’s economic growth has slowed, Soroka says the yoghurt segment will not be negatively impacted. “We think that yoghurt will remain one of the growth areas of the food industry,” he says. “An increasingly health-focused lifestyle and the association of yoghurt with a healthy lifestyle are major factors behind this.”

Higher disposable incomes and a gradual improvement of the yoghurt products available to Chinese consumers also play a role. Another important factor is the growing urbanization of China. As Soroka notes, the vast majority of yoghurt – which most lactose intolerant people can consume because the lactose is broken down during production – is consumed in cities.

“The urban population of China is growing,” he says. “Right now it’s 52 percent — compare that with Russia, where it’s 75 percent, or Europe, where it’s 80 percent.” Currently about 700 million Chinese live in cities, and the United Nations predicts that will increase by up to 70 percent by 2035.

With opportunity comes risk, however, and the biggest risk for any food producer in China today is for a food safety problem to go viral on Chinese-language social media.

Following a number of high-profile food scandals in the country in recent decades, more than 2,000 national food regulations have been brought in, and the government is making significant efforts to improve food safety and quality. A legal framework has been established for implementing food safety management systems, but a lot remains to be done to both enforce these laws and cultivate a wider food safety consciousness.

“Food producers in general pay really close attention to food safety — they’re really trying to maintain a very high standard,” says Soroka. “Building modern factories and buying the right equipment are important, but you also have to change people’s thinking [on food safety], and that is more difficult.”

How to make yoghurt

- Fresh milk and/or cream is fermented using the lactic bacteria starters or ‘cultures’ *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.
- The bacteria are added to heated, pasteurized, homogenized milk, and the milk is then incubated at a specific temperature to maximize the activity of the bacteria.
- The bacteria convert the lactose (milk sugar) to lactic acid, which thickens the milk and gives it the tangy taste. This conversion of lactose means that yoghurt is among the dairy products that can be easily digested by people with lactose intolerance.

Lactose intolerance explained

- Lactose intolerance is the inability to digest lactose a sugar in milk and dairy products. It results from low levels of lactase the enzyme that breaks down lactose.
- Individuals with lactose intolerance who consume milk or dairy products can experience bloating, cramps, flatulence or diarrhoea.
- Lactose intolerance is less common in cultures with a dairy tradition. Therefore, in Northern Europe, around 5 percent of people have lactose intolerance, compared with 90 percent or more in some Asian and African countries. In Southern Europe, around half of the population is lactose intolerant.

Moscow food markets
come in from the cold:

FRESHER CLEANER SAFER

Moscow's traditional open markets have long been plagued by dubious food hygiene standards, dishonest traders and pretty criminals. The mayor of the city was so horrified by the activities taking place among the stalls that he pledged to put an end to what he described as the 'outrages' there. Now, the massive Food City complex is making food shopping in the Russian capital civilized again.

TEXT: **JASON CORCORAN** PHOTOS: **TODD PRINCE**

Moscow's Food City aims to revolutionize food wholesaling and retailing in the city, offering safe, hygienic and convenient shopping.

Food shopping at Moscow's traditional food markets could be a risky business. If the microbes lurking on the meat of unknown origin didn't get you, the bitter cold of the Russian winter, or the pervasive pickpockets, might.

But Moscow's Food City has been hailed by wholesalers, market traders and shoppers for transforming the city's market culture by providing a venue that is hygienic, safe and convenient.

THE SPRAWLING COMPLEX, which stretches over 91 hectares – or about 100 football pitches – is playing a crucial role in overhauling the provision and distribution of fresh food in the Russian capital. When it opened in 2014, it became the largest wholesale food distribution centre of its kind in the country, and it provides

supermarkets, restaurants and consumers with high-quality produce at affordable prices.

The idea to build massive agro-clusters originated in the office of Mayor Sergey Sobyenin, who wanted to push heavy articulated trucks out of the city and into locations beyond the Moscow ring-road, known as MKAD. Under Sobyenin, the Moscow city authorities have closed many of the city centre's open markets, which have been synonymous with pickpocketing, unscrupulous vendors and poor levels of hygiene. Many of Moscow's open markets don't have roofs, while the meat is often displayed unchilled on tables and stalls.

THE CITY'S VAST Cherkizovsky market was an extreme example. In the summer of 2006, there was an explosion at the market, which killed 10 people and injured 55. Two years later,



FOOD REFRIGERATION



Food City hosts around 3,000 Russian and foreign vendors, and is part of President Putin's drive to make Russia "the richest country" in agriculture.

Cherkizovsky was closed amid migration violations and charges that vendors were selling counterfeit goods. As well improving security, the city government and the federal authorities sought to diversify Moscow's food supply chains and make it less reliant on a limited number of channels. Within a year of opening, produce was arriving at Food City from 52 Russian regions and 26 countries for further distribution.

"This is one of the first agricultural clusters in Moscow," explained Sobyenin, a key ally of President Putin. "We've adopted a special law, which specifies new requirements in order to avoid the intermediaries and outrages that took place in other vegetable markets, in order to make trading civilized."

The complex, which is located 25 kilometres to the southwest of Moscow, combines wholesale and retail markets with hotels and office space. The concept incorporates the best international practices of Rungis market in Paris, Mercado San Miguel in Madrid and Berliner Grossmarkt in Berlin.

"It was very important that the project had the support of the Moscow government," says Denis Balacin, Service Operations Head at Food City. "Traffic jams, along with pollution and noise, can be chronic in Moscow and the agro-clusters take the pressure off the city centre by centralizing the delivery and distribution of fresh produce."

Food City is owned by Azeri billionaire partners Zarakh Iliev and God Nisanov, who together own a number of shopping malls in Moscow, as well as Moscow's historical Ukraine hotel. The financial daily *Vedomosti* estimates that the owners have already ploughed \$1.2bn into the project.

THE MARKET IS a key plank in President Vladimir Putin's drive to increase the nation's food security by developing huge tracts of farmland and to make Russia "the richest country" in agriculture. Russia, the world's ninth-biggest food importer in 2013, has already slashed its overseas purchases by 40%, to \$26.5bn last year,

according to government data.

Moscow's population of about 17 million people consumes about 30,000 tonnes of fresh food a day. Food City already meets about a third of those needs, according to Sobyenin, who is pushing for the building of two or three more agro-clusters. A second Food City is in the works, with land already acquired near Domodedovo airport.

About 3,000 vendors – mostly Russian – sell produce at Food City, but the door is open to other countries, with stalls selling exotic fruit, nuts and spices from Syria, Iran, Turkey and Tunisia, among other countries.

Cherry vendor Sadullaev Sarva is much happier at Food City due to the improved security, logistics and hygiene. "I worked at Slavyanskiy Mir market, 15kms away from here, and it was a little dangerous due to a criminal element," said Sarva, who is originally from Uzbekistan. "This is much quieter, more civilized and we have a good flow of wholesale and retail customers keen to buy our fruit." ■



ALFA LAVAL'S RUSSIAN EVOLUTION

WITH MILLIONS OF dollars' worth of international and domestic meat, fish, fruit and vegetables at stake on a daily basis at Food City, the Moscow-based wholesale outlet depends on 700 condensers and unit coolers supplied by Alfa Laval to keep its produce fresh and its customers happy.

Food City chose Alfa Laval because of the reliability of its cooling equipment. In particular, it is capable of withstanding greater pressure, explains Denis Balacin.

However, Alfa Laval also stood out on cost effectiveness and execution.

"Alfa Laval's Moscow factory worked

exclusively for us for an entire month," says Balacin.

"We had a very large order and we were very pleased with the speed of their work." The equipment has performed well since installation and Food City plans to continue working with Alfa Laval in the future, Balacin says.

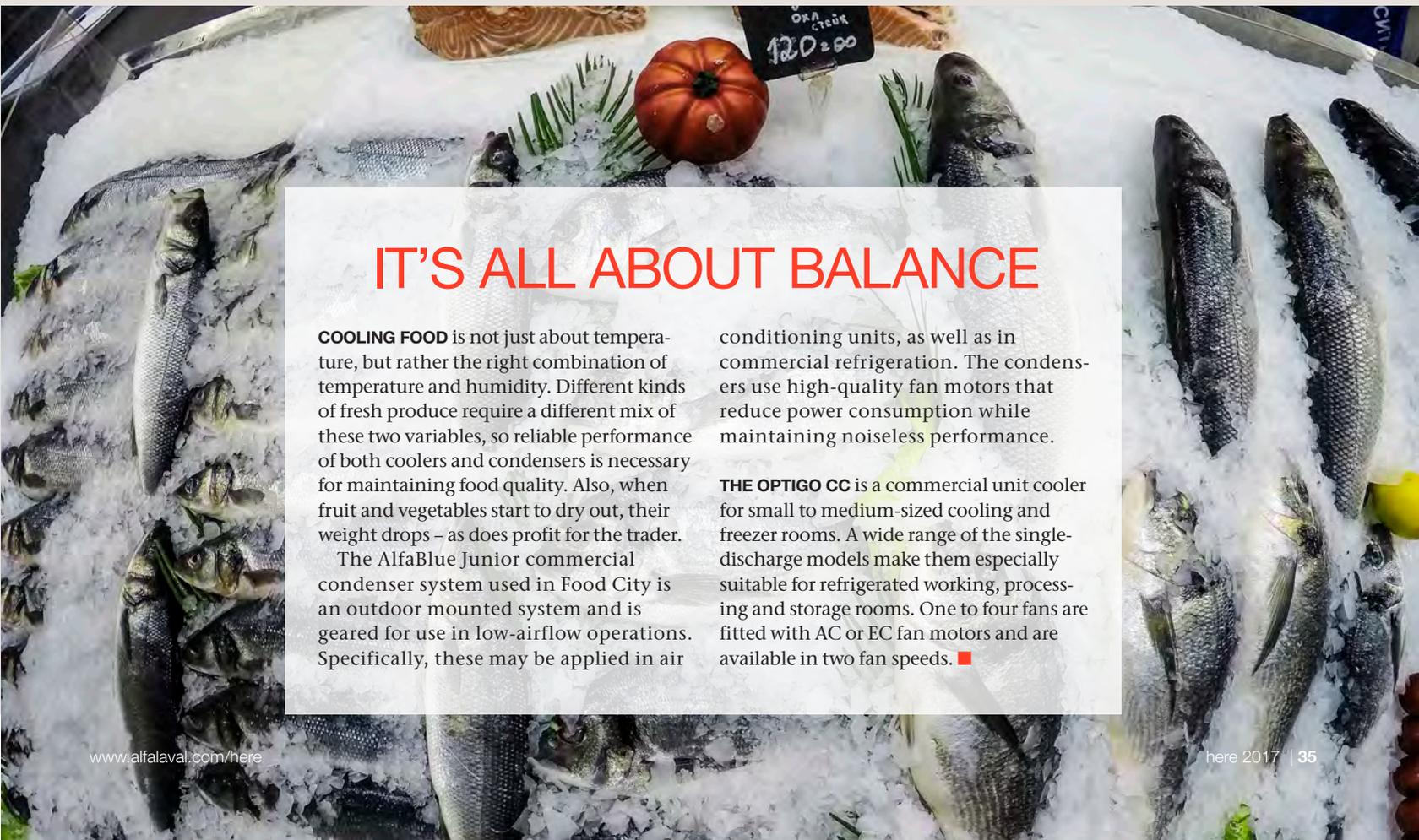
ALFA LAVAL IS set to supply the equipment for the second agro-cluster being created outside of Moscow. "We will provide condensers and coolers," says Pavel Bazhutov, Sales Manager for Refrigeration

at Alfa Laval in Russia. "That's 300 of the same units installed in Food City."

Alfa Laval has partnered successfully for a decade with its Russian distributor Morena, which deals directly with Food City.

"They have been our loyal partners for a decade and we have together built up a strong niche in the Russian refrigeration sector," says Efim Gurevich, Chief Executive at Morena.

Alfa Laval is one of the oldest foreign companies still operational in Russia, having opened its first office in St Petersburg in 1903. ■



IT'S ALL ABOUT BALANCE

COOLING FOOD is not just about temperature, but rather the right combination of temperature and humidity. Different kinds of fresh produce require a different mix of these two variables, so reliable performance of both coolers and condensers is necessary for maintaining food quality. Also, when fruit and vegetables start to dry out, their weight drops – as does profit for the trader.

The AlfaBlue Junior commercial condenser system used in Food City is an outdoor mounted system and is geared for use in low-airflow operations. Specifically, these may be applied in air

conditioning units, as well as in commercial refrigeration. The condensers use high-quality fan motors that reduce power consumption while maintaining noiseless performance.

THE OPTIGO CC is a commercial unit cooler for small to medium-sized cooling and freezer rooms. A wide range of the single-discharge models make them especially suitable for refrigerated working, processing and storage rooms. One to four fans are fitted with AC or EC fan motors and are available in two fan speeds. ■

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Clean water.

Today, more than one billion people lack access to clean water. If we fail to conserve this life-giving resource, the numbers suffering from thirst will increase dramatically.

At Alfa Laval we are deeply involved in this challenge. We convert seawater to freshwater. We cool and heat water. We clean waste water. Our high performance decanters play a key role on the global stage. Installed in their thousands throughout the world, they clean a volume of waste water from a population equalling that of the entire USA. And each year we install new decanters with sufficient capacity to match the needs of everyone in Sweden!



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