NO. 26
AN INTERNATIONAL MAGAZINE FROM ALFA LAVAL

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WASTE TREATMENT:
A close-up of Scotland's green whisky trend

ENVIRONMENT:
Visit the world's most eco-friendly skyscraper

SOLAR POWER:
Proven technology goes large-scale

CAN WE CLEAN COAL?

Massive research is taking place to reduce emissions from coal-fired power plants. Several new technologies are in the pipeline.

"Reliability is critical, which means the equipment must function perfectly in extreme and unstable weather conditions."
Mikhail Tolmatchev, *technical director at ADD Service, which provides mobile power stations in Siberia*

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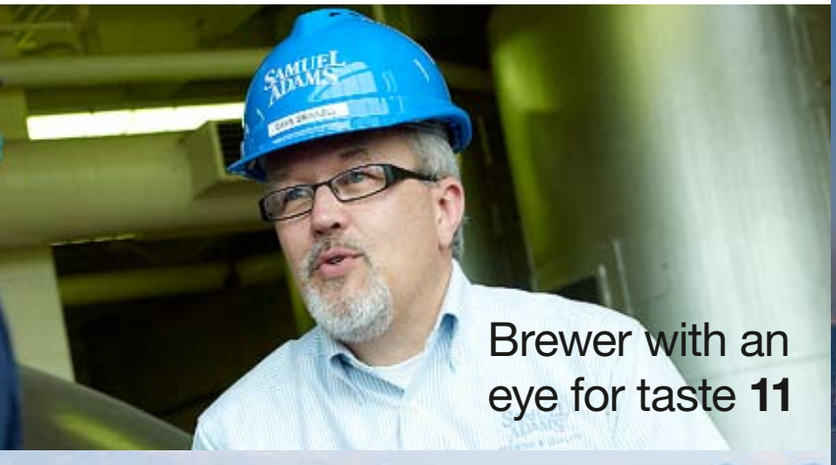

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Highest priority

editorial Can we clean coal? That question is of the highest priority. Coal-fired power plants account for a third of the world's man-made CO_2 emissions, yet coal will remain one of our most important energy sources in years to come.

Alfa Laval can clean coal. We have been working with different carbon-capture techniques for about 10 years. One is IGCC (integrated gasification combined cycle), a process that gasifies coal and separates the sulphur and carbon dioxide from the coal before combustion, thereby preventing the emissions from ending up in the atmosphere. Another is carbon capture post combustion, a process used after the combustion of gas, oil and coal. Together with Statoil we have worked with carbon capture on Statoil's offshore oilrigs, and we are currently starting up pilot projects with various leading companies to find new and improved techniques.

Clean technology is a natural and important part of Alfa Laval. We offer products, solutions and services that help our customers save energy, produce (and reuse) freshwater and reduce emissions.

IN THE REFINERY and petrochemical industries our compact heat exchangers reduce CO_2 emissions and save energy by using waste heat produced in one part of the industrial process for other downstream process applications. Alfa Laval's compact heat exchangers permit the recovery of some 95 percent of heat – representing a 30 percentage point efficiency increase compared with competing shell-and-tube technology.

Sometimes we join forces with other experts to create unique solutions. Our Alfa Laval Alfdex, developed in cooperation with Haldex, is used on trucks to prevent the oily crank case gases from the diesel engines from being released into the air. Alfa Laval PureBallast, jointly developed with Wallenius Water, is the first chemical-free ballast treatment process. It protects seas, lakes and rivers from being invaded by harmful species that travel in ballast tanks from one water body to another.

Alfa Laval has a clear strategy to be involved early in new product and process development, whether it is in cooperation with partners or research institutes or in different pilot projects. Today we are looking into new – and cleaner – ways to produce energy. Second generation biofuel based on non-food feedstock and solar power are just two new interesting areas where Alfa Laval has an opportunity to build a strong position as product and solutions provider. In this issue of *here* magazine you can read about some of these projects.

Enjoy,

SVANTE KARLSSON
EXECUTIVE VICE PRESIDENT AND HEAD OF PROCESS TECHNOLOGY DIVISION


CO2

New technologies instil hope of CLEAN COAL

Coal-fired power plants account for about 40 percent of the world's electricity production, and that figure is expected to rise. Considering the large amount of CO_2 emitted by the plants, huge effort is being expended to find cleaner ways to burn coal.

TEXT: **CAROLINA JOHANSSON** ILLUSTRATION: **ROBERT HILMERSSON**

DESPITE ENVIRONMENTAL CONCERNS, coal is the world's fastest growing fuel, according the BP 2008 Statistical Review of World Energy. Coal is plentiful and cheap compared with fossil fuels such as oil and gas.

In the United States, which has the world's largest coal reserves, more than half of the electricity produced comes from coal-fired power plants. On a global scale, coal provides about 40 percent of the electricity consumed, but as the economies of China and India continue to grow and industrialize this share is likely to increase further, according to the International Energy Agency (IEA).

Meanwhile, coal-fired power plants account for as much as a third of the world's man-made carbon dioxide emissions, believed to be the root cause of global warming. For this reason, limiting CO_2 emissions has been high on the global agenda to reverse climate change.

Finding and developing renewable energy sources is one way to tackle the problem, but it will be a long time before these new technologies are sufficiently developed to provide a serious alternative to fossil fuels. "Even with rapid development of alternative energy sources, coal will continue to be important for at least the next 50 years," says Geoffrey Morrison, programme manager at the London-based IEA Clean Coal Centre. "It's vital to invest in ways of burning coal more cleanly, particularly with regard to the removal of carbon dioxide."

Growing concern over CO_2 emissions and tougher legislation to minimize them have spawned intensive research into technologies to enable cleaner coal production.

Clean coal initiatives basically seek to reduce emissions from coal-fired power plants by employing technologies that facilitate the capture of carbon dioxide. They also address the issue of permanent storage of carbon.

"Carbon capture and storage [CCS] has to be part of any serious and affordable climate change strategy," says Milton Catelin, chief executive of the London-based World Coal Institute. "The IEA tells us that stabilizing emissions without CCS is impossible. If governments are serious about tackling climate change, then they need to get serious about investing in all low-carbon technologies, including CCS."

THERE ARE THREE technologies available today for carbon capture – pre-combustion, post-combustion and oxyfuel combustion.

Pre-combustion capture involves gasification, or turning >>>

"Coal will continue to be important for at least the next 50 years. It's vital to invest in ways of burning coal more cleanly."

GEOFFREY MORRISON, *IEA Clean Coal Centre*

>>> coal into a synthesis gas comprising hydrogen and carbon. The technology, termed "integrated gasification combined cycle" (IGCC), was first successfully demonstrated on a commercial scale at the Cool Water Project in Southern California in the 1980s. There are currently a few commercial-size, coal-based IGCC plants in the United States and Europe, and some pilot projects are being launched, particularly in the US. While the technology holds promise, it requires investment in a dedicated new plant, which makes it relatively expensive.

The two other carbon-capture technologies may be retrofitted into existing power plants and power stations. One is oxyfuel combustion, which involves burning fossil fuels in pure oxygen, resulting in an exhaust stream with a high concentration of CO_2 and water vapour. These are then separated by condensation. The other is post-combustion capture, which involves removing CO_2 from flue gases after hydrocarbon combustion.

Each of these three carbon-capture technologies has pros and cons, according to Morrison. "Pre-combustion capture on IGCC has the lowest energy penalty [reduction of net electric output], but IGCC is not yet in widespread commercial use," he explains. "Oxyfuel and post-combustion capture have higher energy penalties, but they can be potentially applied to existing plants. This is important, given the high inventory of existing pulverized coal-fired plants."

All three of the technologies need to be further demonstrated and tested, he says. And all of them are at present less cost-efficient than traditional coal burning.

Europe currently has several programmes in place to demonstrate carbon capture and storage. The US is developing similar programmes, China is catching up fast, and in Australia a number of small-scale CCS demonstration projects are under way.

"Most people in the industry expect CCS to be commercially demonstrated by 2020," says Morrison.

THERE ARE COST and regulatory uncertainties connected to CCS technology. The issue of clean coal is also controversial, and some environmental groups and others would rather see money invested in renewable technologies. However, the world energy demand is projected to grow by 55 percent between 2005 and 2030, and renewable technologies are just not sufficiently developed to really make a difference.

"Climate change is a serious issue and requires serious funding in all low-carbon technologies – renewables, energy efficiency, nuclear and CCS," says Catelin. "The UN Intergovernmental Panel on Climate Change maintains that CCS could contribute 55 percent of all emission reductions by 2100."

He says public investments in CCS represent excellent value for money. "One large-scale CCS power plant can supply the equivalent low-carbon electricity of 1,400 wind turbines," Catelin says. "The truth is, the world is investing far too little in CCS and other low-carbon technologies." ■

▸▸ **www.alfalaval.com/here/cleancoal**

▸ Alfa Laval's involvement

Growing impact of clean technology

Clean technology permeates many of Alfa Laval's business areas.

"Clean technology is a new market, but Alfa Laval products have always provided customers with solutions that enable them to re-use and protect natural resources such as energy and water in industrial processes," says Alex Syed, vice president of corporate development at Alfa Laval.

Alfa Laval's products and processes address clean technology from three different perspectives: The first is reducing resource use such as water and energy by either using them more efficiently or finding ways to re-use them. The second involves technology for cleaning up existing energy production or participating in cleaner energy production such as solar power or biofuels, products that reduce pollution. The third is about minimizing the environmental impact by utilizing products that reduce pollution.

In terms of clean coal technology, it holds big potential, partly because renewable energy still contributes relatively little to the world's overall energy production.

Alfa Laval has got a dedicated carbon capture team who is developing new techniques and effecient solutions for carbon capture processes. At present the team is involved in several research projects and pilot plants for clean coal technology. In spring 2009, for example, Alfa Laval won a contract to supply Packinox heat exchangers to an IGCC plant at a new US power plant.

"There are legislative factors and government incentives that indicate this area will grow."

"The technology is there, and there are legislative factors and government incentives that indicate this area will grow," says Syed. "There are pilot plants being constructed in the US and Europe, but it is still too early to say how large this market will become. It depends a lot on future legislation." ■

The Norwegian CO_2 capture project will include two test plants at the Mongstad complex.

CAPTURING THE DREAM >>>

StatoilHydro and the Norwegian government are partners in a revolutionary CO_2 capture project. The planned technology centre at Mongstad, north of Bergen, could pave the way for a dramatic reduction in worldwide CO_2 emissions from fossil fuel-fired power plants.

TEXT: **PAUL REDSTONE** PHOTO: **ØYVIND HAGEN/STATOILHYDRO** ILLUSTRATION: **DAVID FIERSTEIN/STATOILHYDRO**

>>>

CLEAN ENERGY COULD be one step closer to becoming reality. Global warming is firmly on the political agenda, with CO_2 now widely acknowledged as a key factor. And power plants burning fossil fuels are subject to growing pressure as the major source of CO_2 emissions worldwide.

Tore Torp, a pioneer of CO_2 capture and the coordinator of StatoilHydro's Europe-wide CO_2 capture and storage research programme at the Sleipner gas and oil field in the North Sea, says the project is an important step forward. "This technology is applicable to all types of fossil fuel and could have major environmental benefits," he says, "but research is needed to reduce the costs and improve performance and reliability. The results will be highly significant for future capture plants."

The project will create two pilot plants to test the most promising CO_2 capture technologies at the new combined heat and power plant at the Mongstad complex, which also comprises an oil refinery, a fractionation plant and a crude oil terminal. The power plant is fuelled by both natural gas and refinery gas. StatoilHydro and government-owned Gassnova have also committed to building a full-scale plant based on the technology that proves most successful.

THE APPROACHES TO BE tested are based on absorption of CO_2 in either amine or chilled ammonia. The technology centre will verify their relative effectiveness and assess which gives the best overall economy – a critical factor. Both have been used commercially in removing CO_2 from natural gas, but this is the first application with purely environmental motives. Aker ASA and Alstom Power have been contracted to build the pilot plants, which will use amine and chilled ammonia respectively.

"Mongstad is a result of the escalating debate around global warming," says Hans-Jacob Svensen, Segment Manager, Energy & Environment, Alfa Laval Nordic. "Private vehicle emissions have long been a political issue, but in fact they only account for around 5 percent of global CO_2 discharge. Power plants burning fossil fuels are responsible for around eight times as much. CO_2 capture technology could reduce total emissions by up to 20 percent. We're proud that Alfa Laval heat exchangers play a part in this."

Another of the project's goals is to develop the market for CO_2 capture technology, which can be applied to power plants fired by any type of fossil fuel. "There are around 7,500 coal-fired power plants, which contribute a large chunk to the total CO_2 discharge," Svensen says. "And more than 500 plants are scheduled to become operational in the coming five years."

STATOILHYDRO AND ALFA LAVAL have a 10-year history of partnership in pioneering CO_2 capture at Sleipner, for which Alfa Laval supplied all the heat exchangers, and the companies recently signed a global preferred supplier agreement for heat exchangers that will pave the way for

▶ The process in brief

100,000 tonnes per year

The Mongstad technology centre will use a post-combustion CO_2 capture process. Heating and cooling are critical aspects, so heat exchangers play a vital role. Each pilot plant will have a CO_2 capture capacity of 100,000 tonnes per year – about 10 percent of the capacity of a full-scale plant.

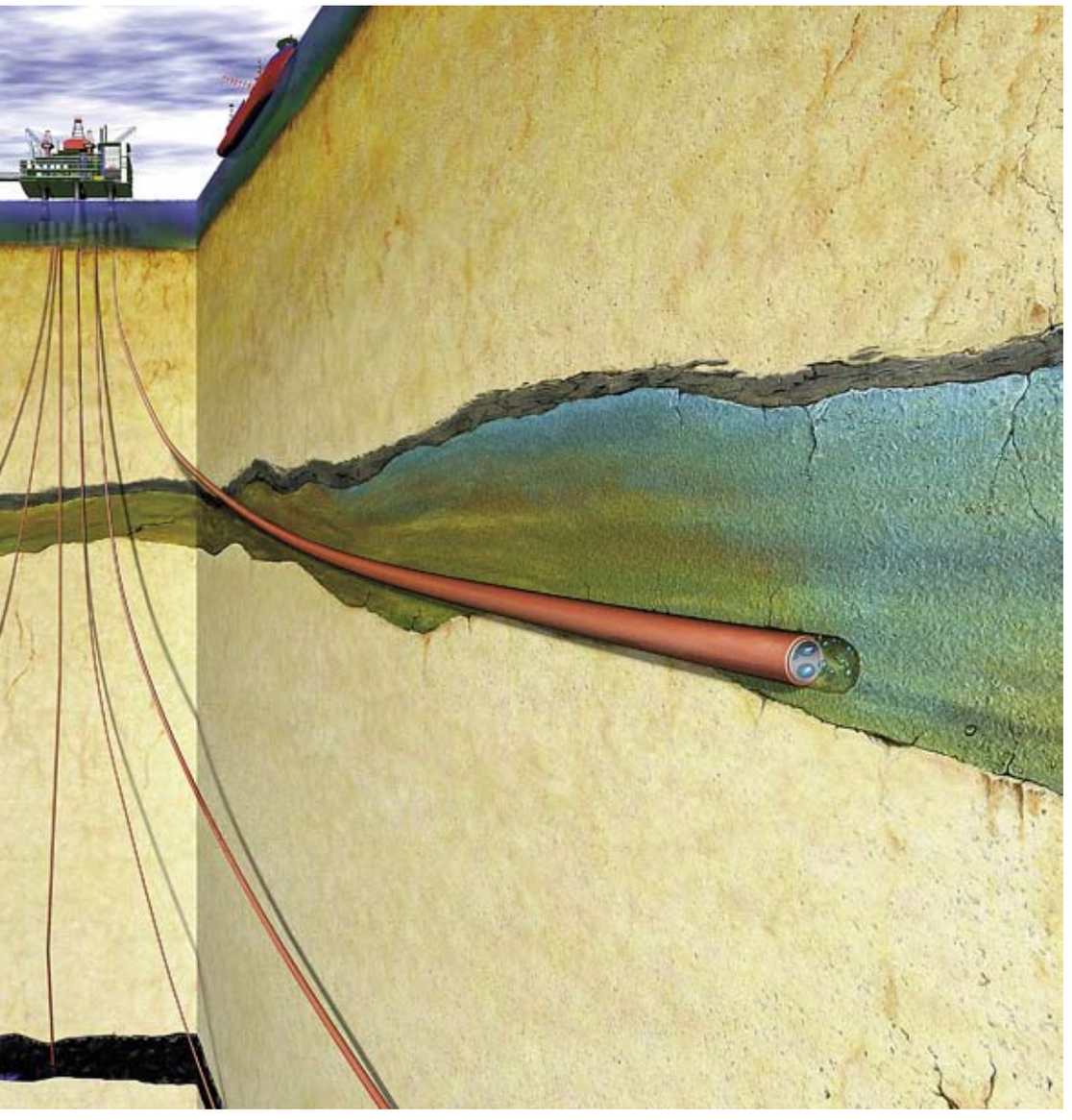
Stage 1: Preparation
Flue gas (exhaust gas that leaves through the chimney) is cooled before entering the capture process.

Stage 2: Absorption
Flue gas is introduced into the bottom of the absorption tower, where it makes contact with a solvent (either amine or chilled ammonia) that travels downwards through the tower's packing material. CO_2 is absorbed by the solvent.

Stage 3: Stripping
The CO_2-rich solvent is transported to the stripper tower for desorption. It enters the top of the tower and travels down through a packing material. Steam is introduced at the bottom of the tower and travels upwards, encountering the solvent. The heat of the steam releases the CO_2. A mixture of steam and CO_2 leaves the top of the stripper. The solvent returns to the absorption tower for reuse.

Stage 4: Collection
The steam and CO_2 mix is cooled. The water condenses, and gaseous CO_2 is collected.

Stage 5: Dehydration
The CO_2 gas is dehydrated and compressed prior to storage.



Capturing CO_2 below seabed can pave the way for a dramatic reduction in worldwide CO_2 emissions.

▸ Facts

STATOIL HYDRO

- International energy company focused on upstream oil and gas operations
- World leader in carbon capture and storage
- Largest Scandinavian oil products supplier
- 29,500 employees in 40 countries; headquartered in Norway
- Operates 39 oil and gas fields
- Average production more than 1.7 million barrels of oil per day
- World's largest operator in waters more than 100 metres deep

more Alfa Laval heat exchangers to be used in projects to come. Alfa Laval will also contribute knowledge, as well as information regarding other products and developments.

The biggest challenges are economic rather than technical, Torp says. "Energy consumption is the toughest issue," he says. "This accounts for 70 to 80 percent of the cost of capture; the chemical reaction in the absorption process is strong, so a lot of energy is required to strip the CO_2 afterwards. Absorption is most effective at low temperatures and separation is most effective at high temperatures, so the circulating absorption medium must be repeatedly cooled and heated. Heat exchangers are therefore a critical part of the process."

Safe storage of the stripped CO_2 is another important area for developing a widespread market for the technology, and this continues to be researched at Sleipner. "More than 11 million tonnes of CO_2 have so far been injected into an aquifer more than 800 metres below the seabed and successfully contained," Torp says.

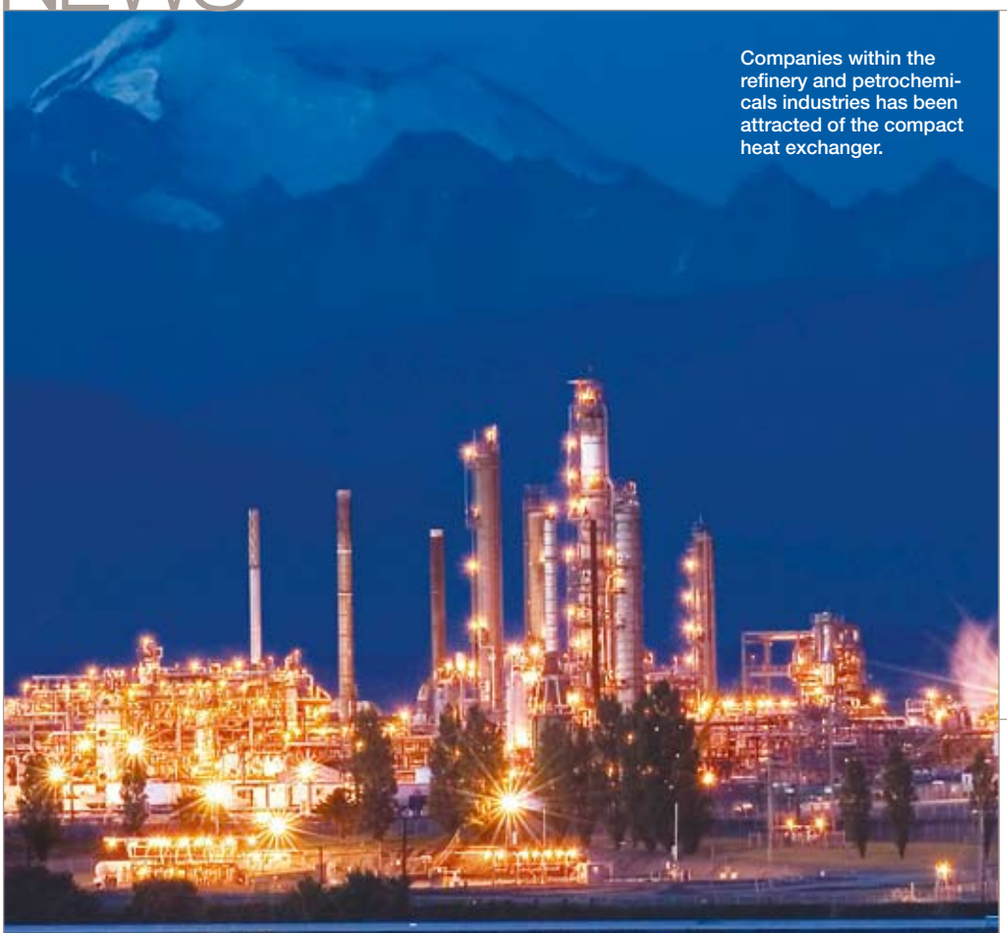
Other challenges for the Mongstad project include the difference in CO_2 concentrations between natural gas and power plant flue gases (exhaust gases that leave through the chimney), as well as scaling up from pilot to full-scale operation. "The performance of the heat exchangers will also be even more critical due to the high temperature of the flue gases," Torp says.

The pilot plants are expected to be completed in 2011 and operative in 2012. The Norwegian government will make a final decision on the full-scale plant when the test results are clear. ■

"More than 11 million tonnes of CO_2 have so far been injected into an aquifer more than 800 metres below the seabed and successfully contained."

TORE TORP, *a pioneer of CO_2 capture and coordinator of StatoilHydro's Europe-wide CO_2 capture and storage research programme*

▸▸ **www.alfalaval.com/here/statoilhydro**



Companies within the refinery and petrochemicals industries has been attracted of the compact heat exchanger.

Great interest in new Compabloc 120

Cuts energy costs and reduces CO_2 emissions

Several orders were placed even before Alfa Laval launched its new all-welded compact heat exchanger the Alfa Laval Compabloc 120. Attracted by the energy-efficiency and compactness of the product, companies within the refinery and petrochemicals industries saw great potential to both cut their energy costs and reduce CO_2 emissions.

The Compabloc 120 is the latest newcomer to Alfa Laval's range of compact heat exchangers and the most powerful and energy-efficient to date, with a unique heat-transfer ability. It is suitable as heater, cooler, interchanger, condenser or reboiler and can replace one or several large shell-and-tube heat exchangers for duties up to 42 bars. Compared to shell-and-tube technology, the Alfa Laval Compablocs represent up to a 50 percentage point efficiency increase, permitting much higher heat recoveries. For an average refinery this translates into a 19 MW reduction in energy consumption and up to 47,500 tonnes less CO_2 emissions per year.

Since lower margins and environmental legislation are forcing the refinery and petrochemicals industries to find new, cleaner and more energy-efficient processes, the Alfa Laval Compabloc 120 is a most wished-for solution.

LG Chem in Korea is one of the companies that has taken Compabloc 120 to heart. The unit will be put to use in the company's ethylene plant to boost the capacity of the quench water coolers. Traditionally, shell-and-tube or gasketed plate heat exchangers are used in this position, but because of difficult and frequent cleaning of the shell-and-tubes and potentially short gasket lifetime of the gasketed plate heat exchangers, LG Chem decided to go with the compact and fully welded design. With the Compabloc 120, the company eliminates these problems.

Another exampel, and one of the first to invest in the Alfa Laval Compabloc 120, was an American refinery. Driven by emission reduction, thermal efficiency and compactness, the refinery will be using three Alfa Laval Compabloc 120 units to cool the water in advance of contacting the FCC (Fluid Catalytic Cracking) flue gas, using water cooled by air as cooling medium. The refinery will also use two Compabloc 120 units for amine re-boiling. ■

Investing in energy efficiency

Alfa Laval has received a SEK 110 million (USD 15 million) order for compact heat exchangers from one of the major refineries in Russia – the world's second largest oil producing nation after Saudi Arabia. Delivery is scheduled for 2010.

The order marks an increased drive to modernize refineries that was built in Russia during the Soviet era.

As a result, the Russian refinery in question will reduce its energy consumption by 340 MW and its CO_2 emissions by 850,000 tonnes annually, equivalent to the emissions of all the cars in Stockholm over a year's period.

"The order confirms that Alfa Laval's compact heat exchangers have an outstanding offer that fits the refinery needs; technical, financial and environmental," says Lars Renström, President and CEO of the Alfa Laval Group. ■

The carbon/ money swap

As an added service, Alfa Laval is now offering to broker carbon financing for its clients.

Regulated and administered by the United Nations, carbon financing is based on companies and governments reducing their greenhouse gas emissions and then selling the ensuing emissions credits to parties that are close to exceeding their emissions quotas.

Example: A German company can't reach its stipulated CO_2 reduction. It buys an emission certificate from a "carbon investor" such as a bank, which then pays compensation to an Alfa Laval customer in China that has invested in CO_2 reduction technology.

Carbon financing grew out of the Kyoto Protocol, in effect since 2005 with the goal of reducing greenhouse gas emissions by 5 percent by 2012. For further information, contact your local Alfa Laval office. ■

David Grinnell, vice president of brewing operations at The Boston Beer Company, is delighted about the improved beer quality.

Crafting the future of beer

Quality is paramount to The Boston Beer Company. Its handcrafted beers are the result of generations of brewing skill combined with the right processes and equipment. The brewer has found that new machinery not only enhances its current product range but also provides inspiration for new styles. >>>

TEXT: **NOREEN COMERFORD, ERIC SCHUPPERT, PAUL REDSTONE** PHOTO: **OZZIE (RVOIIIPHOTO)**

>>> **JUST SIX WEEKS** after The Boston Beer Company launched its first beer, the Samuel Adams Boston Lager®, in 1985, it was voted "Best Beer in America" in the Great American Beer Festival's consumer preference poll. The success has continued ever since, making The Boston Beer Company® one of the top craft brewers in the United States and world famous for its Samuel Adams family of beers.

In 1984, when Jim Koch founded The Boston Beer Company, the company had no office and no distributors. The first beer was simply offered in some two dozen bars and restaurants in Boston. But the timing was perfect, coinciding with growing interest in traditional beers and the dawn of the US craft brewing industry.

There are six generations of family brewing tradition behind the beer. The original Samuel Adams recipe dates back to the 1870s, when Louis Koch, great-great-grandfather of Jim Koch, opened his brewery in St Louis, Missouri. Jim Koch named the beer after Samuel Adams, a revolutionary thinker from Boston who fought for independence in the 1700s. Adams was also in the brewing trade, inheriting the tradition from his father.

Today The Boston Beer Company is a leading independent American brewer. And Samuel Adams beer is still made according to the historical brewing traditions – handcrafted from all-natural ingredients with painstaking attention to detail.

"Our mission is to remind people what beer can be, what beer is supposed to be," says David Grinnell, vice president of brewery operations for The Boston Beer Company.

While protecting the tradition of beer and interpreting traditional recipes, the brewer is also moving into more extreme, flavourful beers. "Our goal is to give beer its noble position on the white linen tablecloth," Grinnell explains. "We want to challenge spirits and wines and move toward a noble position on that table."

IN 2008 THE Boston Beer Company acquired the Lehigh Valley Brewery near Philadelphia, now the Samuel Adams Pennsylvania Brewery. Alfa Laval was chosen to upgrade and modernize the brewery. More than 25 varieties of craft beer are now brewed here, and Alfa Laval's products are relied on at most stages.

Grinnell describes the acquisition as a homecoming. "We were familiar with this brewery," he says, "because we had brewed here during the 1990s. We already knew its ability to make our beer to our high standards. But there had been advances in the industry since then, and solutions like the centrifuge were available to bring the brewery up to date. We brought Alfa Laval into the picture to deliver solutions across the brewing process."

Grinnell notes that there is a certain irony in the relationship between modern techniques and traditional

The tradition of beer is important to The Boston Beer Company, and the original Samuel Adams recipe dates back to the 1870s.

▸ Alfa Laval's brewing system

Recipe for success

Each step of the brewing process adds to the result

The Boston Beer Company's Pennsylvania brewery now features a wide range of Alfa Laval products, including Brew 2000 Centrifuges, Carboblend CO_2 adjustment module, Aldox water deaeration module, Kieselguhr and PVPP dosing units and several dosing stations for additives, CIP station, BaseLine and FrontLine plate heat exchangers, SolidC and LKH centrifugal pumps and LKB butterfly valves. The system also incorporates many Unique Mixproof valves with the ThinkTop automation units.

The main concentration of Alfa Laval products is in the fassing and filtration centre, also known as the cold-side brew house. "This is an area where a number of different streams come together, and many brewing decisions are made," says David Grinnell, vice president of brewery operations for The Boston Beer Company. "It's where we test the recipes, the spices and flavours. We also induce a secondary fermentation here, which is a champagne-like process. Alfa Laval solutions help in all of this."

"By the time it reaches the bottle or keg, our beer has been through seven different Alfa Laval products."

The brewing process starts with malted barley

Founder Jim Koch enjoys the scent of a handful of fresh hops.

Alfa Laval centrifuges ensure an effective but gentle process.

or malted wheat, which is milled and blended with hot water, allowing the starch to be converted into sugar. The sweet liquid is then boiled and flavours added, depending on the recipe. Added ingredients are separated out, and the liquid is cooled by a heat exchanger. It is then fermented, typically for a week, followed by a secondary fermentation. At this point it is cooled to storage temperature in the fassing chamber and aged for one to five weeks, depending on the recipe. After ageing it is run through the separator, cooled by a heat exchanger, stabilized, filtered and carbonated.

Alfa Laval equipment and support builds in more consistency, Grinnell says. "By the time it reaches the bottle or keg, our beer has been through seven different Alfa Laval products," he says. "More importantly, they help reduce product loss. The result is that more now ends up in the glass." ■

"We can offer a wider variety of flavours and control every factor to suit the needs of a particular recipe."

DAVID GRINNELL, *vice president of brewery operations*

brewing, but Alfa Laval's equipment makes an important contribution to the craft, giving The Boston Beer Company more control over the flavour of the beer and enabling greater variety. Another irony, he says, is that the process is actually gentler on the beer than the filtration methods previously used.

"Historically we used horizontal tanks and antique solutions like stand pipes to pull back the solids," Grinnell says, "and we were losing a lot of product as a result. Alfa Laval centrifuges allow us to take the volume of the entire tank and separate solids from the tank bottoms. >>>

"Our goal is to give beer its noble position on the white linen tablecloth. We want to challenge spirits and wines and move toward a noble position on that table."

DAVID GRINNELL, *vice president of brewery operations*

▸ Facts

ABOUT THE BOSTON BEER COMPANY

- Founded by Jim Koch in 1984 in Boston
- Produces around 1.8 million barrels per year
- Present in all 50 US states
- Exports to Australia, China, Germany, Guam, Sweden and the UK
- Has won more international beer-tasting awards in the past five years than any other brewery in the world.

Only the beer moves forward, and we've experienced a tremendous improvement in quality. It means we can offer a wider variety of flavours and control every factor to suit the needs of a particular recipe."

CONTROLLING EACH PART of the process also allows greater creativity in developing new recipes. "It's like having a whole box of crayons instead of just one," Grinnell says. "Now we can design a variety of different styles."

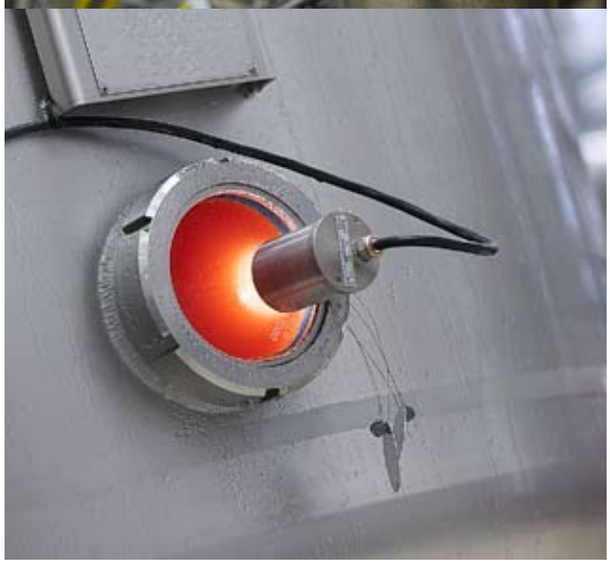
He adds that every stage is essential to the final outcome. "At Sam Adams we see the entire brewing process as our kitchen, and we're always looking for new ways to introduce flavours. Some brewers don't need centrifuges in the places we have them, but we've added stages to the process to add spices, chocolate or whatever the recipe calls for."

Grinnell explains that the company's relationship with Alfa Laval was an important factor in choosing it to refit the Pennsylvania brewery. "We've worked with Alfa Laval for over a decade," he says. "We bought our first brewery in Cincinnati over 10 years ago, and one of the first things we installed was Alfa Laval Brew 2000. Alfa Laval was also willing to take on much of the project management. They successfully managed the full process and were there for us throughout with technical support.

"In addition," he says, "they sent us to training at their Greenwood facility in the Midwest. When we opened the Pennsylvania Brewery Alfa Laval sent trainers for on-site instruction. This is key in ensuring safe and proper use of the equipment."

The Boston Beer Company sees a bright future for craft brewing, says Grinnell. People and tradition are the ingredients for its success. "Our people are the heart of this operation," he says. "They're here for all the right reasons: Either they've brewed here before or their families have. They're excited to be here, and they work with passion. We're most proud of them." ■

The breweing system includes Alfa Laval Unique Mixproof valves with the ThinkTop automation units.



▸▸ **www.alfalaval.com/here/brewery/samueladams**

WWW.STOCKEXPERT.COM

PureBallast is based on a unique water purification technology that combines photochemical and photocatalytic principles and takes advantage of natures own energy.

Prize-winning solution

Alfa Laval PureBallast is the winner of the 2009 Ocean Environmental Protection Award, which recognizes the company or organization that has made the most significant contribution to the reduction and prevention of pollution of the ocean by ships. The award ceremony took place in London in July 2009.

Jointly developed by Wallenius Water and Alfa Laval, PureBallast is the first truly chemical-free ballast water treatment system to be type-approved and certified IMO compliant. It is based on a unique water purification technology that combines photochemical and photocatalytic principles and takes advantage of natures own energy – the free radicals, nature's "cleaners".

IMO classifies the discharge of ballast water as one of the greatest environmental threats to the world's oceans. Ballast water contains microscopic organisms and plankton larvae of larger organisms small enough to pass through the ballast water intakes and pumps. In a new environment with no natural enemies some of these species can become invasive, rapidly out-competing local fauna and flora.

Read more about PureBallast on page 27. ■

Making the most of left-overs

In Uganda fishery by-products are transformed into premium product lines.

As a way to maximize the returns on Nile perch from Lake Victoria Ugandan company Alpha Biotech is now producing omega-3 fish oil, high-grade protein powder and bone-meal organic fertilizer from its fishery by-products.

Owned by the Alpha Group, a leading exporter of Nile perch fillets to Europe, Alpha Biotech built a plant in 2008 for extracting these high-value-added products from the by-products of the Group's fish-filleting operations. Total production is about 300 tonnes per week.

Alpha Biotech's super-modern plant includes an intricate series of pumps, vessels, decanters, separators, purifiers, mixers, filters, heaters and coolers that are all connected by a network of pipes and centrally operated from a programmable logic control (PLC) system process control panel. The equipment was supplied by Alfa Laval.

Previously, the by-products of producing fish fillets were sold to vendors at a nominal price. Now, after processing by Alpha Biotech, these products command a premium price on the world market.

Alpha Biotech's Pure Nile Perch Oil is produced from perch harvested from the waters of Lake Victoria. Because of the purity of the lake's waters, levels of heavy metals, pesticide residues and dioxin are very low.

Omega-3 fish oil and protein powder are well-known nutritional supplements and are used in the treatment of heart disease as well as other medical applications. Malnutrition, a problem in many parts of the world including Uganda, can also be addressed with fish oil and protein supplements.

Equipment from Alfa Laval helps Uganda's Alpha Biotech transform fishery by-products into premium product lines.

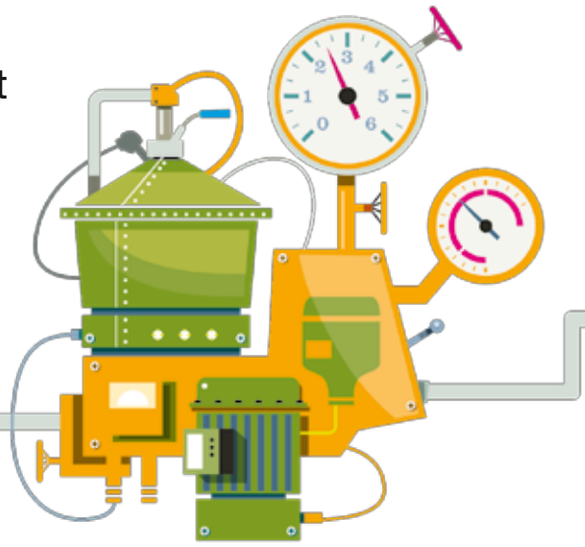
Organic fertilizer, Alpha Biotech's third product line, contains high concentrations of nitrogen, phosphorus and calcium, which are all good for growing plants.

The Ugandan Investment Authority paid special tribute to Alpha Biotech in 2008 when it gave its Presidential Award to the company "for maximizing the utilization of fishery resources." ■

Green spirits

Scotch whisky producers turn to innovative technology to minimize their environmental impact and resource use. Some have already announced major investments to ensure that the industry's environmental reputation remains high.

TEXT: **ELAINE MCCLARENCE** ILLUSTRATION: **KJELL ERIKSSON**



THE SCOTCH WHISKY ASSOCIATION recently launched a major new environmental strategy, which will be in effect up to 2050. This is in line with the industry's efforts to reduce its environmental impact.

The association's strategy covers sustainable water use, packaging, casks and energy. It aims to reduce reliance on fossil fuels by 20 percent by 2020 and 80 percent by 2050, by building on existing efforts. These have already led to a reduction in energy consumption by 18 percent over the past decade at the same time that production has risen by 22 percent.

Energy-saving measures range from small steps such as upgrading a boiler unit to major capital expenditure on heat-recovery systems and novel energy generation.

In addition to whisky, the industry produces several major by-products that need to be dealt with, including draff, spent wash and pot ale. Draff, the solid by-product, is typically turned into an animal feed. Spent wash and pot ale can be concentrated into a syrup or combined with draff to produce "dark grains", both of which are marketed as animal feed.

The economics of handling these by-products depend heavily on location and market forces. In recent years, fluctuating market prices for feedstuffs combined with rising energy costs and more stringent environmental laws relating to waste disposal and carbon emissions have led to new thinking as regards the use of the distillery residues. This includes using them as biofuels to generate electricity.

One company, the Combination of Rothes Distillers (CoRD), which processes pot ale produced by several distillers, is investing 35 million pounds in a combined heat and power plant. It will use draff and pot ale combined with wood as fuel. The plant will have a generating capacity of 7.2 megawatts, and the electricity will be used on-site or sold to the national grid.

IN ADDITION, CORD WILL manufacture biofertilizer products for growing the barley used in whisky production. Alfa Laval's technology will be used in several parts of the process for the separation and drying of these products.

A 65-million-pound bioenergy facility is also under construction at Diageo's largest distillery, Cameronbridge, in Fife. Being built by energy management company Dalkia, the facility will combine a number of sustainable technologies, including biomass conversion and anaerobic

▸ Facts

SCOTCH WHISKY IN NUMBERS

- Scotland has 107 whisky distilleries and exports around 90 percent of its production.
- In terms of capacity Edradour Distillery is the smallest distillery in Scotland, with annual output of 90,000 litres. The Tomatin Distillery is the largest, with production as high as 12 million litres per year.
- The industry employs 10,000 people directly; 41,000 depend on it indirectly.
- There are more than 2,500 brands of Scotch whisky.
- The industry produces two types of whisky – malt and grain. Malt whisky is made with barley; grain whisky uses other cereals as well.

digestion, in which volatile organic materials are broken down in the absence of oxygen using bacteria.

The facility will generate renewable energy from spent wash, which is separated into liquid and dried solids. The liquid is then converted, via anaerobic digestion, into biogas, and the dried solids form a biomass fuel source. "We are using well-proven technology in an innovative manner," says Duncan Stewart, bioenergy project manager at leading distiller Diageo. The solution will reduce annual CO_2 emissions at the site by about 56,000 tonnes when it begins operations in late 2010. Around 90,000 tonnes of residues will be turned into bioenergy in the form of electricity and steam.

This project is in addition to a 100-million-pound investment programme currently being undertaken by Diageo in Scotland that includes a new distillery at Roseisle that will also feature combinations of sustainable technologies, particularly for heat and water recovery. At Cameronbridge, a new process area will include an improved heat-recovery system to ensure more efficient use of energy for cooling requirements. The use of water will be minimized and almost a third of the site's water requirements will be met through recovery.

▸ Alfa Laval's solutions

Serving the whisky industry

Alfa Laval's separation and heat-transfer technology can be used throughout the whisky production process – from fermentation to distillation and stillage handling, where by-products are concentrated.

The company's main products for whisky production are heat exchangers, decanters and membranes.

Heat-exchange technology is found in pre-heaters, which heat the ingredients prior to distillation, and fermentation coolers, which work to obtain the optimal yeast temperatures needed for fermentation, as well as evaporators and condensers. Alfa Laval's plate technology for heat exchangers is more efficient, compact and accurate than traditional shell-and-tube technology.

Decanters and membranes separate solids and liquids. Alfa Laval has a proven and unique package of decanters and membranes that can achieve a clean, non-pollutant, final effluent for disposal whilst producing biofertilizer of value from pot ale in an efficient and cost-effective way.

Alfa Laval has more than 40 years of experience in decanters for the whisky industry, with 25 decanter installations in Scotland.

Globally there are more than 100 Alfa Laval decanters used for alcohol drinks production. Its development of power plates for this product has led to lower power consumption, which is combined with mechanical reliability and improved separation leading to higher efficiencies. ■

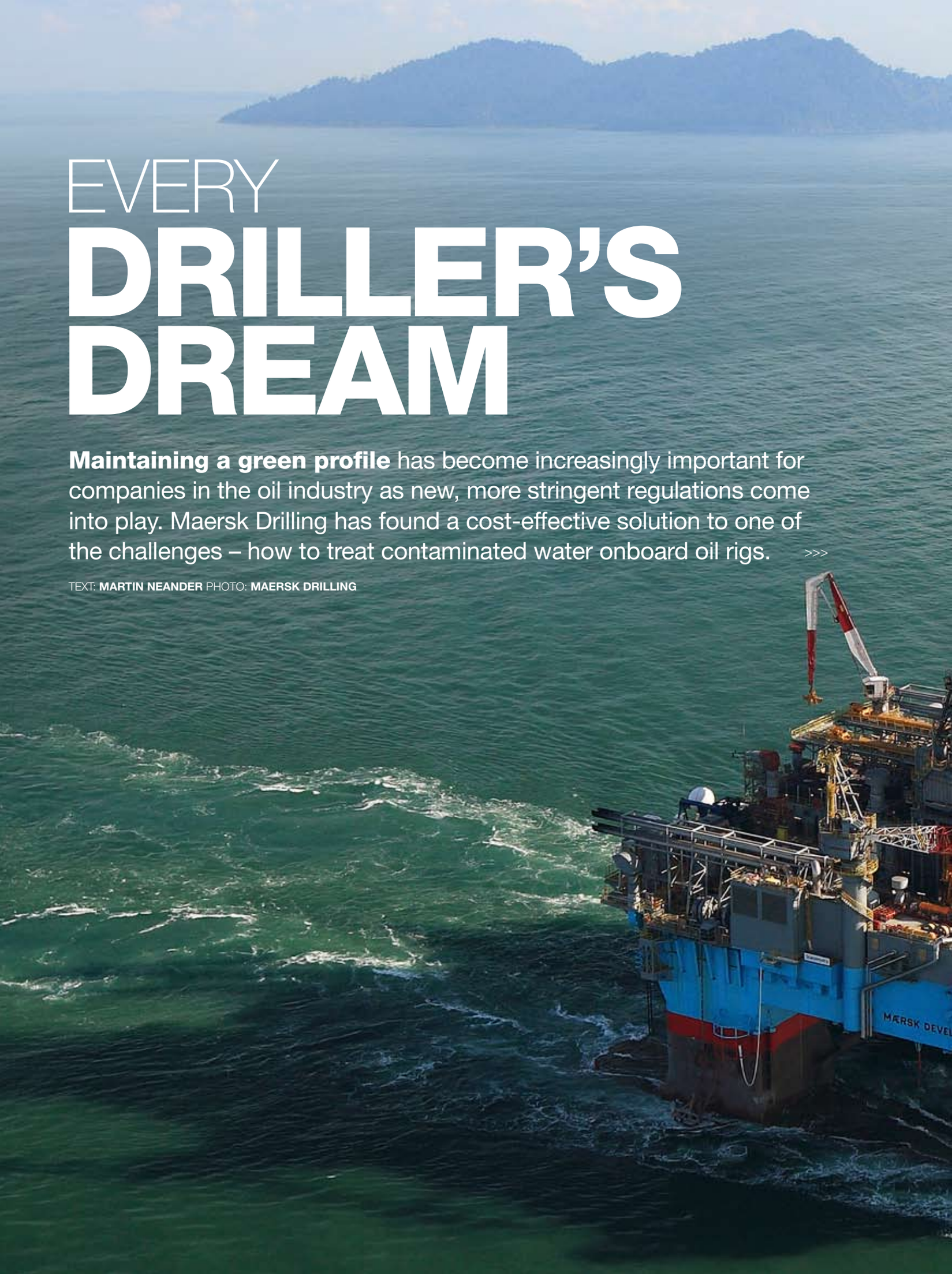
For the industry as a whole, setting a green strategy for the next 40 years demonstrates a long-term commitment to an environment that sustains the unique character of a drink appreciated all over the world. ■

▸▸ **www.alfalaval.com/here/distillery/whisky**

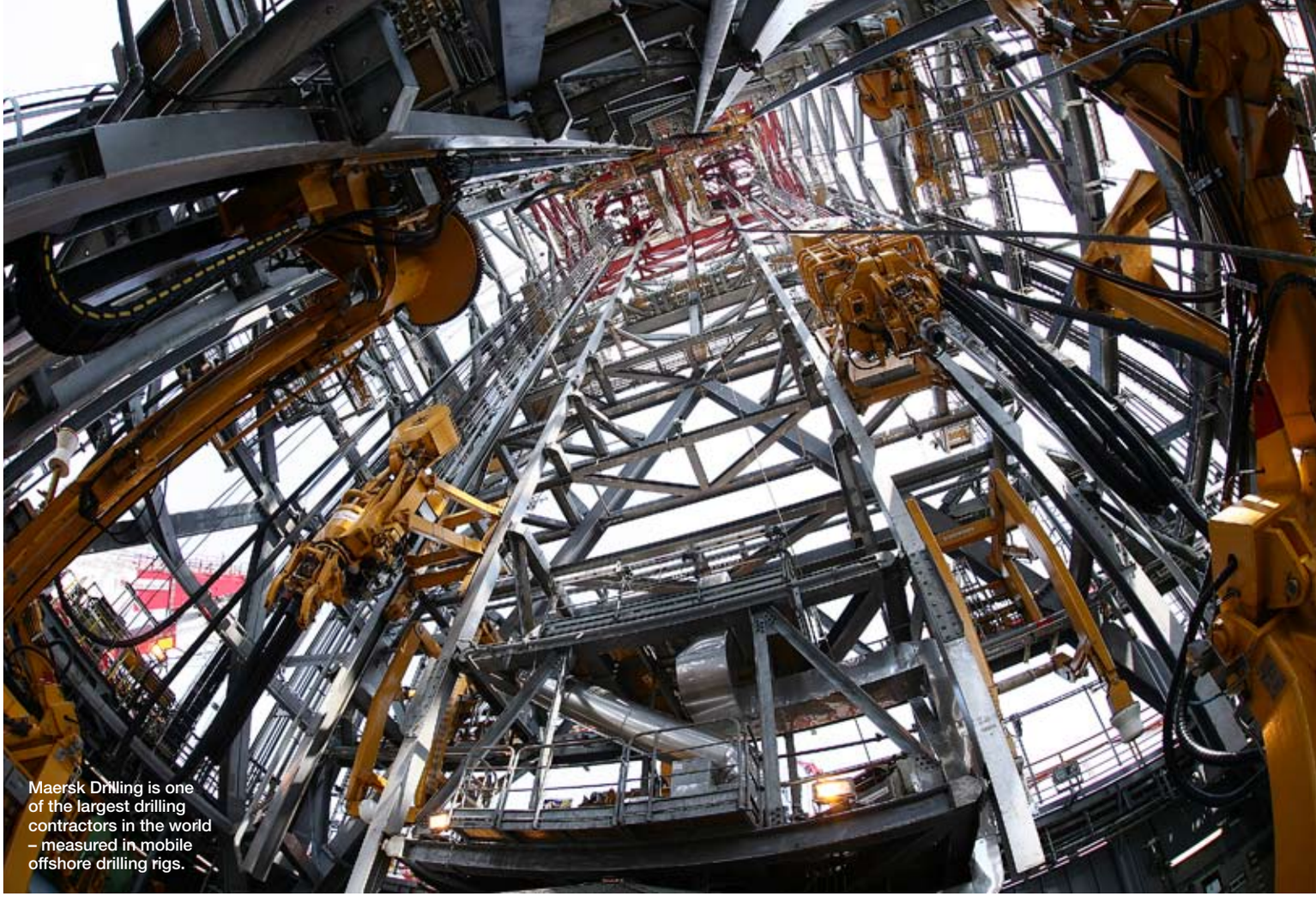
EVERY DRILLER'S DREAM

Maintaining a green profile has become increasingly important for companies in the oil industry as new, more stringent regulations come into play. Maersk Drilling has found a cost-effective solution to one of the challenges – how to treat contaminated water onboard oil rigs. >>>

TEXT: **MARTIN NEANDER** PHOTO: **MAERSK DRILLING**



The Maersk Developer on its way to the Gulf of Mexico, where the first factory-built Alfa Laval Phoenix system will be put to use.



Maersk Drilling is one of the largest drilling contractors in the world – measured in mobile offshore drilling rigs.

>>> **RUNNING ENVIRONMENTALLY** safe operations is crucial for companies within the oil industry. Oil spills from both tankers and offshore oil rigs can wreak havoc with the marine environment and cause irreversible harm to a company brand. Not only will the company name be connected to the incident in countless headlines affecting public opinion, but investors may decide to turn their backs as well.

"Produced" waters – formation water, brine, injection water and other technological waters – also pose an environmental hazard, one that increasingly stringent legislation is seeking to eradicate.

When drilling for oil, injection water is pumped into the injection wells in quantities of hundreds of thousands of tonnes to maintain the pressure in the system and push the hydrocarbons toward the producing wells. Formation water and brine are extracted along with oil. All of these waters are typically polluted by oil, natural low-molecular-weight hydrocarbons, inorganic salts and technological chemicals, and must be cleaned before they are discharged into the sea.

The International Maritime Organization regulations say that water discharged from drilling rigs can contain a maximum of 15 parts per million of oil. But countries and regions also apply their own legislation, which companies in the oil industry must abide by, and the stringency of this legislation varies.

MAERSK DRILLING IS one of the largest drilling contractors in the world – measured in mobile offshore drilling rigs – and operates a worldwide fleet of drilling rigs and mobile production units for oil companies to rent. The company has made environmental improvements a part of its overall strategy.

"To live up to our strategy," says Gregers Kudsk, vice president and CTO, Maersk Drilling, "we run a comprehensive environmental performance programme, which forms the baseline for our plans to reduce emissions and the total impact on the environment as a result of our activities."

Part of that commitment is to clean the dirty water onboard the company's oil rigs.

Offshore rigs operate with large volumes of mixtures of oil, water and solids, and the mixtures are often in the form of complex emulsions that are difficult for traditional separation systems to tackle. Cleaning under marine conditions is a complicated technical task.

A common solution is to store the water onboard the rig until it can be shipped to shore for cleaning. This is usually paid for by the oil companies and can cost as much as 600,000 euros in a year to clean roughly 3,000 cubic metres of contaminated water.

"For Maersk Drilling it has been important for our rig operations to find a solution that can deal with all sources of water contamination directly onboard our rigs," says Ulrik

▶ Facts

WORLDWIDE OPERATIONS

Maersk Drilling is part of the AP Moller–Maersk Group and is one of the largest drilling contractors in the world – measured in mobile offshore drilling rigs. Other company facts:

- Founded in 1972
- Headquarters in Lyngby, north of Copenhagen, in Denmark
- Offices in 11 countries
- 9,500 employees worldwide
- 26 oil rigs in use in the North Sea, Brunei, Dubai, Caspian Sea, Gulf of Mexico and other regions.

> "It has been important for our rig operations to find a solution that can deal with all sources of water contamination directly onboard our rigs."
>
> **ULRIK FRIIS,** *head of Technical Support, Maersk Drilling*

Friis, head of Technical Support at Danish Maersk Drilling. "These sources include bilge water, tank cleaning, deck drains and drill-floor drains."

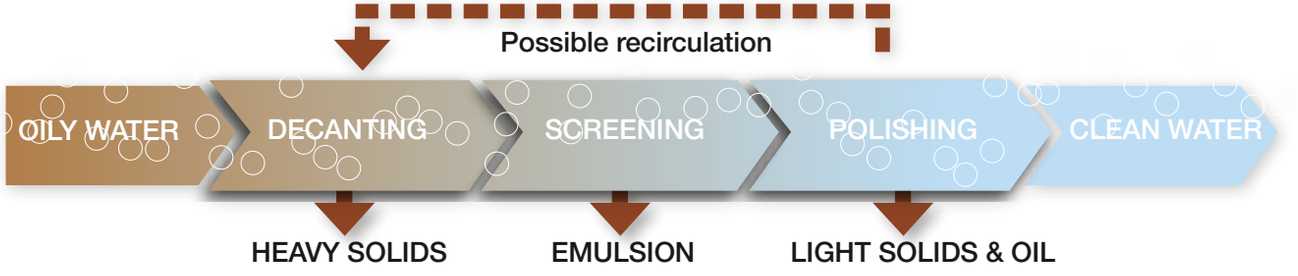
Solutions for cleaning contaminated water onboard the oil rigs include static filtering units, mechanical separation and chemical treatment, all inadequate for cost-effective processing of oily, contaminated water. Gravity settling is a slow, ineffective approach that requires plenty of space and large quantities of chemicals. Filtration systems can only separate solids from liquids, and have limited capacity. Centrifugal separation alone cannot remove all the types of contamination in widely varying concentrations and at different flow rates.

"The static filtering is cheaper to use than mechanical separation," says Friis. "But it's also my experience that filtering alone is not as efficient as a separation technique. The drill mud creates different kinds of emulsions, which filtering solutions can't handle in a good way."

MAERSK DRILLING HAD tested a chemical treatment system that Friis says was very efficient, but the high operational cost and the use of chemicals were major drawbacks. Maersk Drilling wanted to determine whether a screening solution using chemicals could be combined with a mechanical Alfa Laval system for cleaning contaminated water onboard oil rigs, which was already onboard its deepwater semi-submersible drilling rig in the Caspian Sea, the Maersk Explorer. Maersk Drilling invited Finnish chemicals company Kemira and Alfa Laval to carry out tests.

The final outcome was a new system called Alfa Laval Phoenix, which involves a decanter centrifuge module, a screening module and a disc stack centrifuge module. >>>

▶ The Alfa Laval Phoenix system



Clean water in three steps

The Alfa Laval Phoenix contaminated water treatment system combines different separation cleaning techniques in one system.

The system features three separate modules, each designed to remove specific contaminants from the water stream in order to tackle the different separation requirements: a decanter centrifuge module, a screening module and a disc stack centrifuge module.

The decanter centrifuge deals with the initial stage in the treatment process, focusing on solids removal.

The following screening stage is a combination of mechanical separation and chemical dosing, although the system is built to minimize chemical consumption. In this step emulsion composed of small colloidal particles and droplets bound together are removed. Finally the disc stack centrifuge is used to separate low concentrations of oil and fine particles.

"The screener can remove some of the viscous oil without clogging up," says Ulrik Friis, head of technical support at Danish Maersk Drilling. "This makes the job easier for the disc stack centrifuge. While all three components remove different kinds of contaminations, they can help and complement each other for the best result."

The Alfa Laval Phoenix system ensures that all water leaving the system is cleaned to the appropriate level. A three-way valve with an oil-in-water monitor at the outlet of the system recirculates water that contains more than 15 parts per million of oil back into the system to be processed again.

The system is also built to minimize energy consumption.

"The payback time for the Phoenix system is 13 to 14 months," says Franck Gregoire, business manager for oily water treatment at Alfa Laval. "This is based on a cost–payback analysis we have done, looking at issues such as investment costs, partnering services, consumables and chemicals. We compared the Phoenix to the next best alternative, which was to collect all the water in large tanks and ship for treatment onshore." ■

"We have had good experiences from Alfa Laval's system on Maersk Explorer, and we are looking forward to seeing the new system in action in the Gulf of Mexico."

ULRIK FRIIS, *head of technical support, Maersk Drilling*

Maersk Drilling has 26 oil rigs in use around the world. The company has made environmental improvements a part of its overall strategy.

>>> Says Franck Gregoire, business manager for oily water treatment at Alfa Laval, "Maersk Drilling specified how it wanted the system to work, and we provided our expertise on how to separate different liquids. So we really developed the new system in conjunction with the customer."

The Phoenix system works in three steps: First a decanter removes the bulk of the solids, then a screener unit removes the emulsions, and finally the disc stack centrifuge takes away the oil and the rest of the solids.

The three-step solution was first installed in a retrofit version onboard the Maersk Explorer. It proved to be both robust and flexible. Later the first factory-built Phoenix system was installed on Maersk Developer, a new-built highly advanced deepwater development semi-submersible rig that will go into operation in mid-2009 in the Gulf of Mexico with StatoilHydro as its first customer.

"The reason for installing Phoenix on our Maersk Developer oil rig is that we have had good experiences from Alfa Laval's system on Maersk Explorer," Friis says. "And we are looking forward to seeing the new system in action in the Gulf of Mexico."

He says the difference between the retrofit unit on Maersk Explorer and the new Phoenix on Maersk Developer is that the new system provides better system control. "On the new Phoenix unit the different parts are more aligned to work together," he says. "It will be highly intuitive to use, and operations are much more automated."

APART FROM THE FACT that Phoenix can save a lot of volume, space and weight on drilling rigs – the use of Phoenix requires a 30-cubic-metre feed tank for the oily water, in contrast to an ordinary storing tank, which normally must be big enough to hold 300–500 cubic metres of dirty water – Friis points out that the contaminated water treatment onboard will be attractive to oil companies, because they will no longer have the cost of shipping the dirty water onshore. "This is an advantage for Maersk when we negotiate contracts with oil companies," Friis says.

New Phoenix systems will also be installed on two similar semi-submersible rigs that are being built at the Keppel Fels shipyard in Singapore. The first one of the two will be used in Australia by oil company Woodside and will go into operation in spring 2010.

Expectations of the new system are high. "If Phoenix turns out to be a success, there is the possibility that it will become standard on our drilling rigs in the future," says Friis. ■

▸▸ www.alfalaval.com/here/watertreatment/maersk

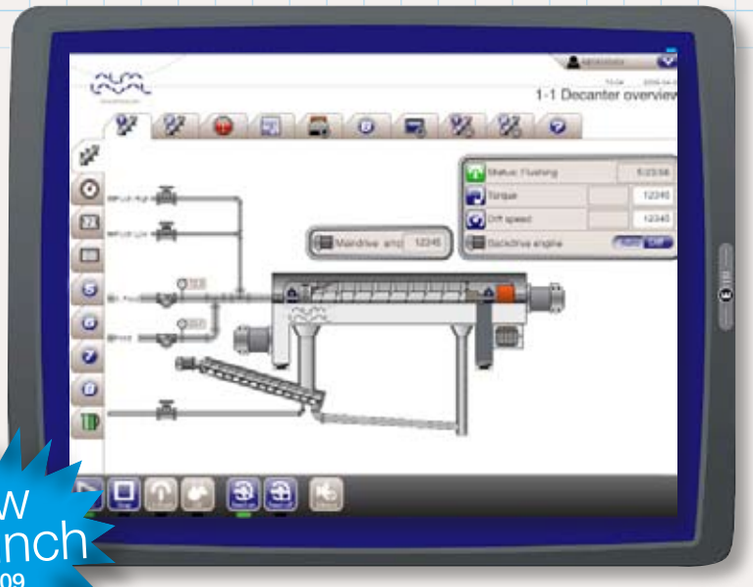
▸ Facts

RIGOROUS LEGISLATION

- The International Convention for the Prevention of Pollution from Ships, known as MARPOL, is valid for marine activity. The convention is adopted by the International Maritime Organization (IMO). MARPOL 73/78 deals with the prevention of contamination from vessels.
- The requirements for oil separation and filtration equipment are safeguarded by the Marine Environment Protection Committee (MEPC), which is a subsidiary of the IMO. As of 2003, resolution MEPC.107 (49) states that oil separation and filtration equipment must be able to purify oil-contaminated and emulsified wastewater to an oil concentration below 15 parts per million – 0.0015 percent by volume.
- There is also various national and regional legislation that must be taken into account. Norway, for example, is putting pressure on oil companies and drilling contractors to comply with its legislation, implementing severe sanctions for non-compliance.

LET US PRESENT:

Alfa Laval 2Touch



new launch 2009

Decanter control made easy

FEWER PIECES TO PLUG IN and more benefits to work with – this is the new Alfa Laval 2Touch control system that now is standard on all new ALDEC G2 decanters. Compared with other control systems, the 2Touch offers more functions while being much easier to use.

"Simplicity has been key when developing 2Touch," says Karsten Madsen, project manager, Alfa Laval. "We have made the system simple to use and simple to integrate."

The system has a 15-inch touch screen, which is much larger than other standard control-system screens on the market, and it has a unique user interface. As the name suggests, the system operator only needs to touch the screen twice to get to any information he or she wants. User manuals, presentations, service videos and other useful information are built into the system and easily accessible when needed. The Alfa Laval 2Touch can also handle a wide variety of languages and scripts, and when possible it uses graphics instead of words to guide the user.

"FLEXIBILITY IS ANOTHER thing we have emphasized," says Madsen. "The idea is that the 2Touch should be compatible with the customer's existing control systems; you just have to change a few parameters on site."

By basing the system hardware on standard and proven components used in other industries, Alfa Laval has ensured a reliable and future-proof control system.

Other tasks made easier are process support and troubleshooting, not least thanks to the built-in modem that allows for remote monitoring. "This means the operator can react quicker to a problem and cut back on the time spent on direct attention standing by the centrifuge," says Jamie Hodd, manager of the sales support team.

This feature also allows Alfa Laval service personnel to carry out remote monitoring of its decanters, translating into cost-efficient service for the user.

Unlike most other control systems, the Alfa Laval 2Touch comes integrated with all new G2 decanters, ensuring that the user gets a factory-tested and completely functioning system.

In autumn 2009, the 2Touch will also be available for retrofit installations on Alfa Laval decanters. Moreover, Alfa Laval is using the same system platform to develop control systems for other product ranges; high-speed separators are first in line, followed by Compabloc heat exchangers.

"The 2Touch control system for decanters is the first wave of an overall upgrade of Alfa Laval's control systems," says Hodd. ■

▸▸ **www.alfalaval.com here/present/2touch**

Customer's voice

"A municipal wastewater treatment plant in Vinje, south of Oslo, needed to upgrade the decanter. We recommended Alfa Laval and its new 2Touch decanter system. This system gives the plant a significant upgrade. The use of Ethernet communication makes it much easier to implement."

Espen Karlsen, manager at the electrical department, Krüger Kaldnes AS

▸ Facts

ALFA LAVAL 2TOUCH BENEFITS

- Cuts installation costs, commissioning time and running-in costs
- Provides greater efficiency in key separation processes and improved operating reliability
- Works with multiple industry-standard communication protocols
- Integrates easily with other plant and equipment control systems
- Is easily upgraded with technology updates and integrates seamlessly with valuable advanced-monitoring and optimization packages
- Saves on manpower and training costs with consistent, easy-to-use interface
- Is easy to troubleshoot and service, ensuring maximum uptime.

Solar power goes large-scale

BRIGHT FUTURE

PHOTO: KJKOLB

Solar energy is seen as an increasingly viable alternative to energy generated using fossil fuels. New technologies are constantly being developed, and the expectation is that solar energy will make a significant contribution to the world energy supply by 2050.

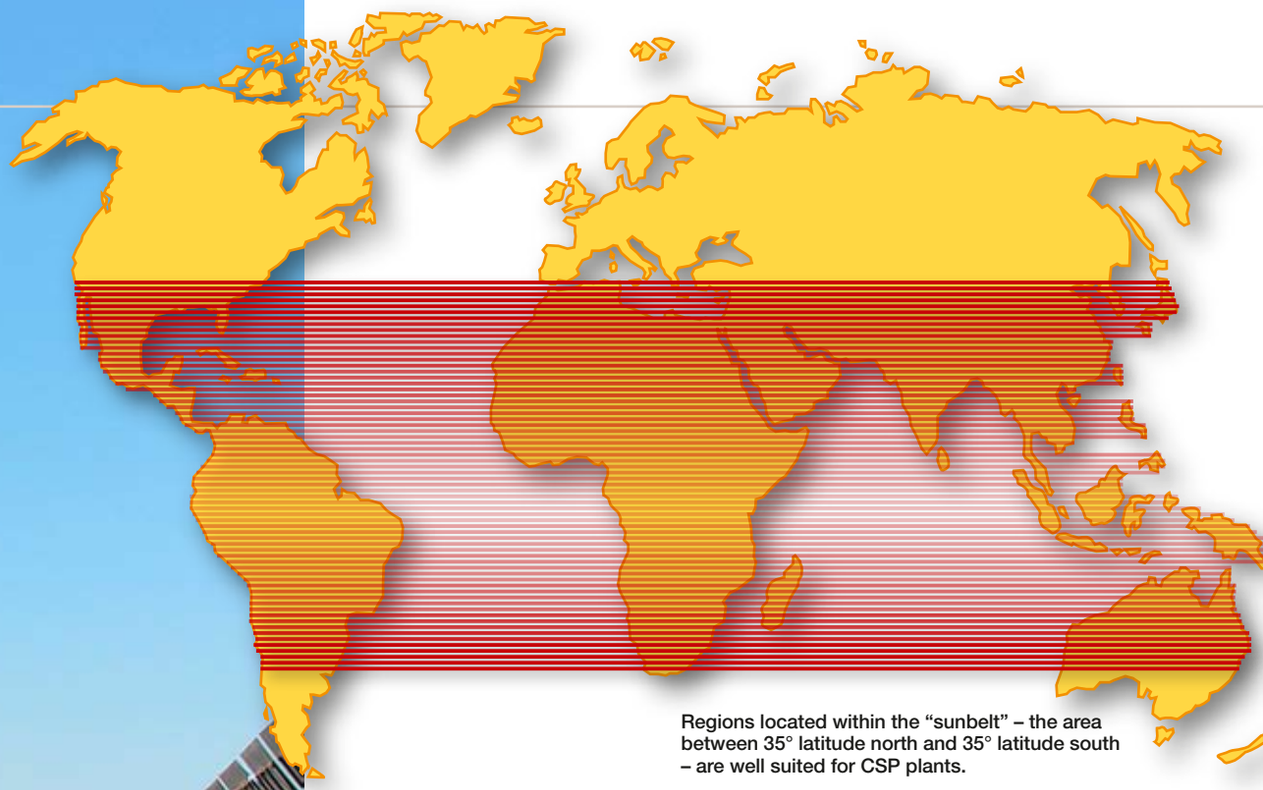
TEXT: **ÅSA LOVELL**

TECHNOLOGY EVOLUTION COUPLED with government regulations and incentives have set off a new surge of interest in large-scale solar power production. Spain and the United States are the two countries leading the development in concentrated solar power (CSP), building huge solar power plants, and it is estimated that a combined total of more than 5,600 megawatts of new capacity will be in use by 2012, enough to meet the electrical needs of more than 1.7 million homes.

In the US, CSP plants have been up and running since the 1980s, but new government regulations triggered a new wave of investments in 2006, and there are dozens of projects under way. Meanwhile, the Spanish government has triggered huge investments in solar power through feed-in tariffs, making CSP plants a profitable business.

Compared to photovoltaic (PV) technology, which generates electricity directly from solar radiation, CSP technology uses large sun-tracking mirrors to concentrate solar radiation, which is then absorbed by a heat-transfer medium that subsequently transfers the thermal energy to make steam. Steam turbines power an electrical generator, creating electricity. Based on these principles, there are different types of CSP technologies – for example, parabolic trough and solar tower systems (see facts box).

"CSP technology is cheaper than PV when installed in areas with lots of sun and clear skies for most of the year, because you can concentrate the solar radiation," says Cédric Philibert, senior analyst at the Renewable Energy



Regions located within the "sunbelt" – the area between 35° latitude north and 35° latitude south – are well suited for CSP plants.

"Every hour the earth receives an amount of energy from the sun comparable to the world's yearly consumption."

CÉDRIC PHILIBERT, *Renewable Energy Unit, IEA*

Unit at the International Energy Agency (IEA). While PV solar power costs about 25 euro cents per kilowatt hour, solar power from CSP costs 13 to 20 euro cents per kilowatt hour, depending on the location, he says.

Thanks to the thermal phase, CSP plants can have a guaranteed capacity. "Storing heat is much cheaper than storing electricity," explains Philibert. "It's better to store the heat before turning it into electricity."

CSP plants can also be equipped with backup systems using fossil fuels at little extra cost, to make sure the plants can be run even in times of long cloudy days.

CSP PLANTS ARE USUALLY built in areas where the peak load takes place in the summer and the electricity is mostly needed for air conditioning, not heating. In those places available solar radiation coincides with peak demand.

One such area is Sanlúcar la Mayor, about 32 kilometres west of Seville in southern Spain. There the company Abengoa Solar is building the Solúcar Platform. When completed in 2013, the platform will cover an area of 800 hectares. It will have 10 solar power plants with a total capacity of 300 megawatts, which is enough energy to supply 153,000 households while preventing 185,000 tonnes of carbon dioxide emissions annually. More than 99 percent of the capacity will be generated using CSP technologies.

In 2007, the world's first commercial CSP plant using tower technology went into operation at the Solúcar Platform, the PS10, with an installed power of 11 megawatts. Two parabolic trough plants, the Solnova 1 and 3, are under construction, each with a 300,000-square-metre collector area that covers 120 hectares of land and 50 megawatts of capacity. In the pipeline are three additional Solnova plants with equally large capacities.

"The reduction in costs recorded, thanks to the evolution of PTC [parabolic trough collectors] technology, has meant that major progress has been made," writes Manuel J Valverde Delgado, general director of Abener-Abengoa, in the Spanish industry magazine *Techniberia*. "Despite this, however, we are still unable to compete with traditional combined-cycle power plants that use natural gas."

Alfa Laval has so far supplied plate heat exchangers to >>>

▸ Facts

CSP TECHNOLOGIES

- Trough systems use linear-parabolic mirrors to concentrate radiation onto a receiver tube through which flows the heat-transfer fluid.
- Tower systems use flat mirrors, called heliostats, to track the sun on two axes, to focus radiation to a fixed receiver at the top of a tower.
- Linear Fresnel systems concentrate light using flat mirrors gathered to approximate parabolic troughs.
- Dish Stirling engines uses parabolic mirrors to track the sun on two axes, to focus radiation onto a receiver; the thermal energy operates an integrated Stirling engine.

>>> three of the Solnova plants. Each Solnova plant uses two T20 units and one M6 unit. The Alfa Laval T20s are used to cool down the components of the turbine, while the Alfa Laval M6 model is the blow-down cooler of the heat-recovery steam generator. "We considered the Alfa Laval heat exchangers the best overall option, given the technical-economic relationship," says Ana Cabañas Burgos of Abengoa Solar. "We have used them in the past in other types of plants with satisfactory results."


Abengoa Solar is investing in trough technology at the Solúcar Platform in southern Spain.

PHILIBERT OF IEA says plenty of areas in the world are suitable for CSP technology. In addition to southern Spain and the southwestern US states, CSP plants would be effective in Mexico, Australia, countries in the north and south of Africa and in all countries located in a belt stretching from the Middle East to central Asia and China.

"We considered the Alfa Laval heat exchangers the best overall option."

ANA CABAÑAS BURGOS, *Abengoa Solar*

There are already CSP plants under construction in Egypt, Algeria, Morocco and Iran, and several other countries have CSP projects under consideration.

Considering the endless resources of solar radiation, the future for solar power looks bright, says Philibert. IEA predicts that solar power will make up 11 percent of the total electricity production in 2050, compared with less than 1 percent today. "The available solar resources are 9,000 times greater than our actual energy consumption," says Philibert. "Every hour the earth receives an amount of energy from the sun comparable to the world's yearly consumption."

The largest CSP investments today have been in tower and trough technologies. In the next five to 10 years, 80 percent or more of CSP plants will use trough, says Philibert. There will also be towers of different designs and working fluids. "Many experts believe that the tower technology will dominate over time," he says, "but not everyone agrees. It's really too early to say which design will be the best."

While large-scale solar power holds vast possibilities, it is still in its infancy. To reach its full capacity there are a series of challenges to address. Valverde Delgado says the industry must find ways to bring down costs and increase energy efficiency. At the same time, further work is needed to engage the support of governments, particularly governments in developing countries, and to deal with legislative hurdles and geographic dispersion and implementation. Also investment in infrastructure and transport is needed. Progress is being made, but a lot of work remains before solar energy can be considered a true alternative to fossil fuels. ■

▸▸ **www.alfalaval.com/here/solarpower**

▸ Solnova setup

Powered by the sun

How solar radiation becomes electricity

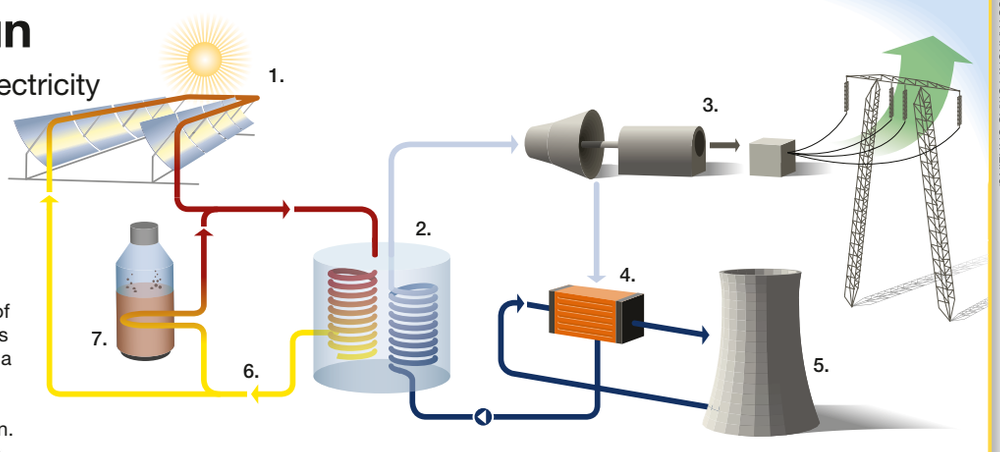


ILLUSTRATION: TOMAS ÖHRLING

1. The mirrors focus sunlight on a pipe that runs down the centre of the trough. This heats synthetic heat-transfer oil that flows through the pipe.
2. In the steam generator, water is heated into pressurized steam.
3. The steam drives the turbine, where Alfa Laval T20s are used to cool down all the components. The turbine drives the generator that produce electricity. The transformer feeds the electricity into the transmission grid.
4. Steam that comes out of the turbine is fed through a condenser, where it is cooled down.
5. The water is cooled further in a cooling tower, where Alfa Laval M6 units are used to cool down the blowdowns.
6. The oil is transferred back into the troughs.
7. Oil can also be fed through a boiler powered by natural gas to fire the steam turbine on cloudy days and at night.

INFORMED DECISION

Nynas installs PureBallast on bitumen tankers

PHOTO: SAMIR SOUDAH

FOUR QUESTIONS for Björn Karlsson, Nynas Group shipping and project manager.

Your company is the first to install ballast-water cleaning systems onboard tankers. Why did you make that decision?

"New IMO [International Maritime Organization] regulations will be effective soon, saying that you either have to clean your ballast water onboard or exchange the water out at depths of 200 metres or more. Our bitumen ships usually don't traffic such deep waters, so we need the equipment.

"We decided to act now, rather than wait for the regulations to take effect. It is better to invest when we are building new ships than to build in the equipment later on. Now we have the opportunity to plan for the required space."

How important is the environmental aspect in your decision?

"Protecting the environment is in general very important to our company. As regards ballast-water treatment, it could never be wrong to lead the way and stand up for these new systems that will be required soon anyway."

Why did you decide to go with the Alfa Laval PureBallast system?

"In my opinion it was the best system available, both the system itself and the availability of service and spare parts in our trading area. We scanned the market for available equipment and looked at systems from companies all over the world before we decided to go with PureBallast.

"PureBallast is one of four systems that are approved by the IMO, which was a critical factor. We also appreciate that PureBallast is chemical free. To kill bacteria using chemicals doesn't feel right.

"In addition, we have a long-lasting, good relationship with Alfa Laval. Personally I've been working with them for more than 35 years. We have several Alfa Laval products installed on our ships. These new ships, for example, will also be equipped with Alfa Laval separators, booster units and freshwater generators. I know Alfa Laval can provide good service and is close by with spare parts."

You're the first company to install a system such as PureBallast on your tankers. Do you think others will follow?

"They won't have much choice once the new regulations take effect. This will happen gradually, but in 2016 the rules will apply to all players and all ships, including our existing tankers. We will soon have to install ballast-water cleaning systems onboard them as well." ■

▸▸ **www.alfalaval.com/here/pureballast/nynas**

EXTREME POWER PROVIDER

The Vysochaishy gold mine, deep in the harsh Irkutsk region of Siberia, needs reliable electricity in order to operate. Mobile stand-alone power plants that can cope with the area's extreme weather conditions make it possible to extract the inaccessible riches.

TEXT: **PAUL REDSTONE** PHOTO: **ADD**

AN ANCIENT SIBERIAN myth tells of an extra sun and moon that heat the world to unbearable temperatures and then cause it to freeze. In Siberia's unforgiving climate it is easy to see how such a myth might come about. For half the year, temperatures are consistently below freezing and can plummet as low as –50 °C. And yet in the summer months temperatures can soar to almost 40 °C.

The Irkutsk region covers almost 775,000 square kilometres at the centre of the Asian part of Russia. It's an area rich in natural resources, with sizeable deposits of practically every commercially valuable mineral. It is one of Russia's biggest gold producers and has large reserves of oil and gas, diamonds, potassium, titanium, table salt, mica and iron.

But the region also has harsh weather conditions and difficult terrain. Russian energy consulting and engineering specialist ADD must deal with these factors on a daily basis as it works to supply power to local communities and industrial operations. Reliable electricity is essential for industrial operations such as the Vysochaishy gold mine, and critical for local populations in order to survive the hostile winter.

ADD's robust mobile power plants are what makes it possible to deliver electricity, heat and cooling to remote rural areas not connected to the national power grid, and its solutions are deployed throughout Western and Eastern Siberia, the Urals, the Volga region, Yakutia and Uzbekistan.

THE VYSOCHAISHY GOLD MINE'S main processing plant has the capacity to produce 1.2 million tonnes of ore annually, but extracting it is a challenge. Daily temperatures fluctuate dramatically, dropping by as much as 30 °C at night. "Vysochaishy" means "the highest" in Russian, and the mine's highland location also makes strong winds a hazard. ADD's power plants must be tough enough to handle the tough conditions, which was a decisive factor when ADD chose Alfa Laval to supply AlfaBlue air heat exchangers and control units.

"Extraction processes are expensive, and stoppages due to equipment breakdown can have a serious effect on profits," says Mikhail Tolmatchev, technical director at ADD Service. "Reliability is critical, which means the equipment must function perfectly in extreme and unstable weather conditions. Alfa Laval products have never failed us."

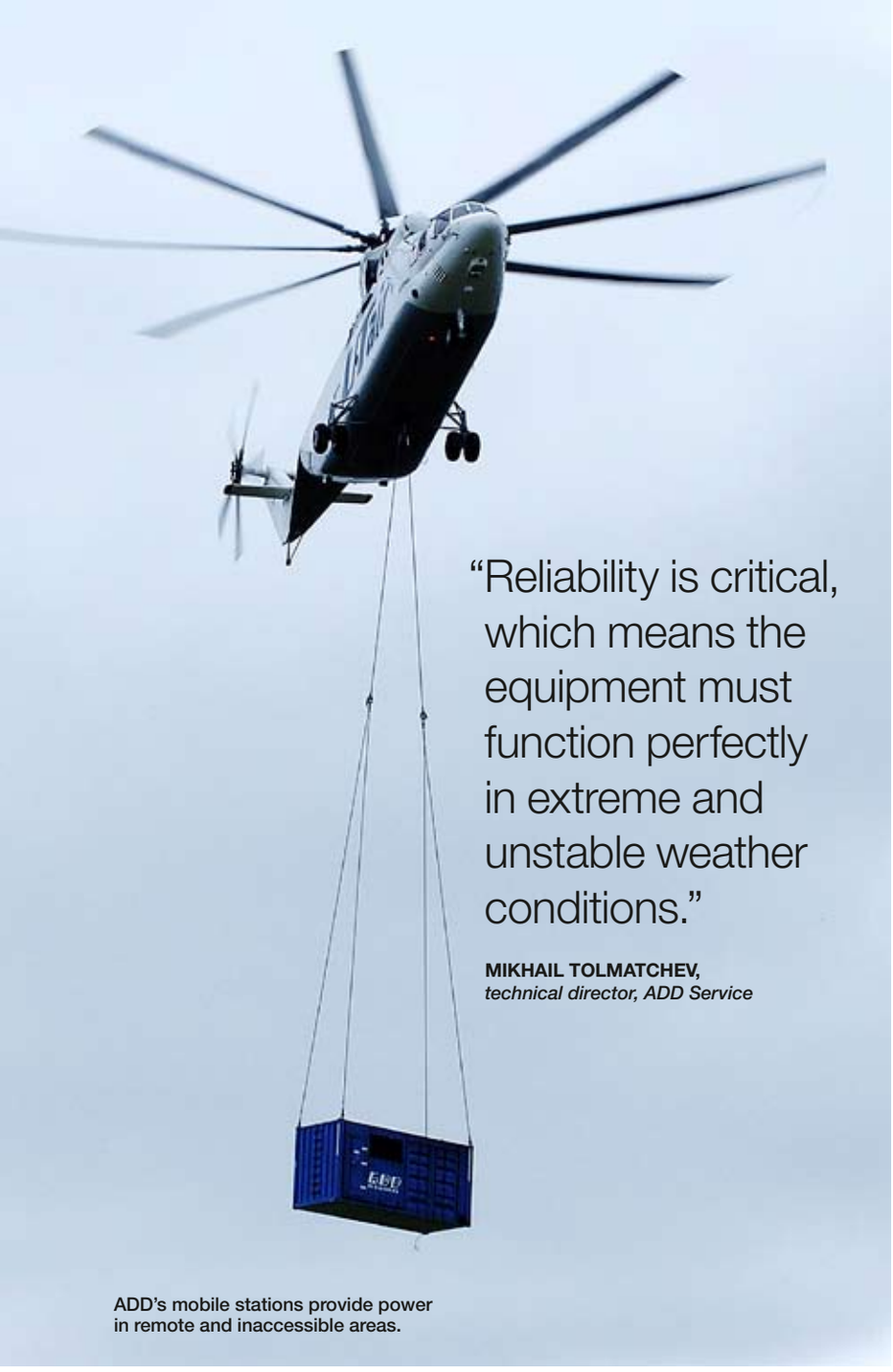
Tolmatchev adds that the need for reliability is compounded by the lack of roads in regions such as Irkutsk. "In many areas, spare parts can only be delivered in winter, when the ground is sufficiently frozen to make transport possible," he says. "So we simply cannot take risks when it comes to quality."

>>>

▸ Facts

ABOUT ADD GROUP OF COMPANIES

- Provides engineering solutions and consulting services for power applications, using energy-efficient technologies
- Operates in almost all regions of Russia
- More than 2,000 employees
- Over 200 projects completed since 2000 in areas including mining, residential, utilities, transport and telecommunications.



> "Reliability is critical, which means the equipment must function perfectly in extreme and unstable weather conditions."
>
> **MIKHAIL TOLMATCHEV,**
> *technical director, ADD Service*

ADD's mobile stations provide power in remote and inaccessible areas.

But quality and reliability are not enough. The special conditions within the mining industry make it crucial that the power generation system is mobile, enabling it to be moved to a mining location precisely when it is required."

The solution used is based around diesel- or gas-powered generators mounted on special mobile containers. Power can be quickly supplied where needed, and the plant can be easily dismantled and moved to another location. Typical applications include mining exploration, or filling in while a permanent power plant is under construction.

"This business model gives our customers freedom from operational worries," Tolmatchev says. "When they need power to an area, they call us. We work out the best technical solution, then assemble the plant on site and ensure that it is running correctly. When it is no longer needed, we take it away. The customer simply pays for the power we supply."

Viktor Obraztsov, chief project manager at ADD Engineering, stresses the importance of the close relationship that has developed during the five-year cooperation with Alfa Laval. "Each project has its own unique challenges, and the engineers need to coordinate a great deal of technical information," he says. "This influences the selection and use of equipment, so an understanding with suppliers is essential. Alfa Laval specialists always respond rapidly to our requests, and their dedication to getting to the heart of a problem ensures that we achieve the right solution in every case." ■

▸▸ **www.alfalaval.com/here/mobilepower/siberia**

▸ ADD's mobile power stations

Tough enough for Siberia

The system used by ADD at the Vysochaishy gold mine is based around a Caterpillar diesel generator with a maximum power of 5.7 megawatts – equivalent to the output of the largest, most modern wind power stations in existence today. Because of the limited availability of freshwater, they are air-cooled.

AlfaBlue air heat exchangers, also known as dry coolers, are a key element in the power plants. "Their robustness, high capacity and energy efficiency were decisive factors for ADD," Obraztsov says. "Another big plus was the flexibility of the component design. Different coil geometries, single or double fan rows, fan diameters and a wide range of fan motors can be mixed and matched to provide the optimum performance for a specific application. And they can be easily disassembled for transport."

"The dry coolers' robustness, high capacity and energy efficiency were decisive factors for ADD."

ADD selected high-performance dual dry coolers with the largest coil size, low-temperature fan motors, a low-speed fan rotation system and an electric panel with fan-speed control. Equipped with four 910-millimetre-diameter fans, each unit can handle airflow rates of up to 145 cubic metres per hour.

The AlfaBlue frame and casework are designed to provide high rigidity for heavy-duty applications, protecting the heat exchanger tubes against vibration and thermal expansion during transport and operation. They are made of galvanized steel, treated for corrosion resistance. ■

ADD relies on Alfa Laval dry coolers when constructing its mobile power stations.

Heat from geothermal groundwater

A small Turkish town is meeting its heating needs by exploiting the heating potential of geothermal groundwater. Alfa Laval plate heat exchangers make this possible.

Balçova, a small municipality in the coastal province of Izmir in western Turkey, is using its natural geothermal groundwater as a heat source for district heating and domestic tap water. At the heart of the system are 1,500 plate heat exchangers from Alfa Laval.

Large-scale resources of geothermal groundwater are primarily found in areas of the world that are close to the continental shelves.

Turkey joins China, the United States, Iceland and Japan as the countries with the largest reserves of hot geothermal groundwater. In spite of this vast potential, however, only 3 percent of Turkish geothermal resources have been exploited.

The district heating system in Balçova, which has a population 68,000, is attempting to change that.

Built and operated by Izmir Jeotermal Energy, a company jointly owned by the metropolitan municipality of Izmir and the provincial government, the district heating system recently accessed hot water from the nearby Seferhisar field where new wells were drilled in 2008.

In 2009, long-term production tests were successfully conducted on the recovery of heat from the new wells, and the pilot project became a reality.

"When it comes to equipment, we simply had to have the best," says Ali Ichedef, General Manager of Izmir Jeotermal Energy. "Our suppliers had to prove they had a powerful capacity for after sales services and emergency preparedness. And Alfa Laval fulfilled these criteria by a safe margin."

The equipment to circulate hot ground water to Balçova's district heating network includes the MX25, M15, TL10, M10 and M6 plate heat exchangers from Alfa Laval.

According to Ichedef, the cost for maintenance and spare parts has been cut by 20 percent since Alfa Laval equipment was installed.

Balçova's district heating network includes 3,900 substations, 1,500 of which were delivered by Alfa Laval.

"Alfa Laval's high thermal performance and minimized downtime has cut costs by 50 percent in parts of the system," says Ichedef.

The gradual exploitation of the vast geothermal resources within the Balçova region has given the Alfa Laval team some valuable experience when it comes to the technicalities involved in transferring geothermal energy.

"Reliability and minimized downtime are crucial in order to realize the full potential of geothermal energy systems," says Erkan Erpolat, Sales Engineer at Alfa Laval Turkey. "Our know-how and expertise are available around the clock and on very short notice." ■

Large-scale resources of geothermal groundwater are to be found in various areas around the world. Turkey is one of them.

A TOWER TO ADMIRE

It's a beauty, even in the eyes of Mother Nature. The new tower at One Bryant Park in New York City represents a big step towards a greener Manhattan.

TEXT: **HENRIK EK** PHOTO: **PONTUS HOOK**

FROM BREAKING NEW GROUND on Third Avenue in the 1950s to installing fuel cells in buildings in the 1990s, The Durst Organization has consistently been one of New York City's boldest real estate developers.

The Bank of America Tower at One Bryant Park, in the heart of Midtown Manhattan, is the latest example of how Durst's innovation continues to reshape the city's skyline. Magnificent design goes hand in hand with cutting-edge technology to produce advanced environmental benefits.

The tower is built from recycled steel and a concrete mix containing about 45 percent slag and fly ash, which are by-products of steel production. Durst's ambition during construction was to obtain as much of the material as possible from within a range of 800 kilometres (500 miles). This allowed for the builders to cut greenhouse gas emissions by limiting transport distances as well as by reducing heavy concrete production and other material refining processes.

"This is 'Ice Stone'," says Jordan Barowitz, director of external affairs at Durst, touching a surface on the front desk. "It's made out of recycled glass, and we used this material in the lavatories as well, in place of what would have otherwise been stone." The material is manufactured in Brooklyn, just across the East River from Manhattan.

Barowitz and his colleague Don Winston, vice president of technical services, point out other "green" features in an office space on the 49th floor. "The floor and the ceiling are bamboo, which is rapidly renewable, unlike hardwood floors from old-growth forests," Winston says. "The carpets are made from recycled materials."

But it is 50 floors down that the real savings are made. Three stories below ground, the building features some of the most sophisticated heating, ventilation and air-conditioning equipment in the world. There, Alfa Laval plate heat exchangers are used in parallel with the building chillers to save energy. During the four to five months of the year when ambient temperatures are low enough, outside air and a cooling tower are used to produce chilled water in the plate heat exchangers. This reduces or eliminates the need for mechanical refrigeration and dramatically cuts the use of electricity to cool the building. Appropriately, the system is called "free cooling".

BUT EVEN IN THE height of summer, One Bryant Park can save energy through the use of ice thermal storage in the basement. "We have a chiller that is dedicated to ice making," Winston says. "It's part of a closed loop system >>>

▸ Facts

BANK OF AMERICA TOWER AT ONE BRYANT PARK

Height: 366 metres (1,200 feet). Second tallest building in New York after the Empire State Building, fourth tallest in the United States

Number of floors: 54

Floor area: 195,000 square metres (2.1 million square feet)

Architects: Cook+Fox

Mechanical engineers: Jaros Baum & Bolles

Cost: 1 billion US dollars

Reused/collected water: 38 million litres (10 million gallons) annually

>>> where an ethylene glycol solution circulates through the chiller and a coil of plastic tubing in the ice storage tanks. The cold glycol solution produced in the chiller simply freezes the water surrounding the coils in the tanks."

All this happens at night, when the cost of electricity to run the chiller is at its lowest. At 8 am, when the cost of electricity climbs, the cycle is reversed and the ice melts.

"That's when the glycol solution is circulated between the ice tanks and the Alfa Laval plate heat exchangers, which then essentially act as a chiller," Winston says. The glycol is between –8 and –3 degrees Celsius (17.6 and 26.6 Fahrenheit), depending on the point in the ice-melting cycle.

But cooling with ice to limit the use of peak-hour electricity isn't the only energy-saving measure The Durst Organization has taken. The building is also equipped with a cogeneration plant that employs more Alfa Laval heat exchangers and generates 4.6 megawatts of electricity, or 75 percent of the annual electrical energy consumed by the building. "The exhaust gas from the engine goes through a heat-recovery boiler and produces steam," Winston says. "The steam is then used to heat the building in the winter and to run a smaller absorption chiller during the summer. We use somewhere around 70 percent of the total energy in the natural gas we use as fuel, instead of about 30 percent that is used at a utility power plant."

THAT SAVES MONEY and also cuts carbon dioxide emissions, but Durst is still rolling out its full operating protocol. Some construction remains, even though the tower already houses Bank of America's New York headquarters.

Among the eco-friendly features that will be up and running soon is a system to collect rainfall and reuse other water. The water will ultimately be used as make-up water in the building's cooling towers and for toilet flushing. The total water conservation programme, including waterless urinals, will save some 38 million litres (10 million gallons) a year.

"We had to think about everything," Winston says. "It's hard to build something with so much glass and still be energy-efficient. It harvests a lot of daylight, but it also comes with challenges in thermal comfort. Regarding the green part of this, that's just how The Durst Organization is doing it. The green commitment is our way."

"From a leasing perspective it's also a compelling selling point," Barowitz adds. He says tenants such as banks and law firms are happy about lower energy costs, but they also see a value in investing in their people. Ample light and clean air make the employees happier and more productive.

"Building like this is more challenging, but you have to take risks in development," Barowitz says. "Not everyone has the stomach for it, but Durst has always been in the vanguard, all the way from the 1950s."

Since the building is brand new and not all the systems are up and running yet, there are not enough data to say for sure how One Bryant Park will measure up to other skyscrapers in terms of environmental savings. But the structure is heavily instrumented, and the goal is to make numbers public in 2011.

"We're absolutely satisfied so far," Winston says. "There are many areas, especially from a technical perspective, where we have exceeded any building I've ever been involved with." ■

►► www.alfalaval.com/here/cogeneration/onebryantpark

A successful team of innovators

The Durst Organization takes pride in being ready to evolve and to adjust course, preferably in a daring and innovative direction. History has proven that that's a good way to do business.

"The road is constantly changing, and Durst always tries to partner with people who are willing to innovate," says Jordan Barowitz, director of external affairs at The Durst Organization, a New York real estate giant. "Alfa Laval is certainly such a company."

There are many reasons to choose Alfa Laval's HVAC solutions, according to Don Winston, Durst's vice president of technical services. "Their commitment makes them a good choice," he says. Referring to Peter Newman, Alfa Laval's local sales representative, he says, "We've always had a great working relationship with Peter in terms of understanding the performance and specifying the right product."

Winston also saw a maintenance advantage in picking Alfa Laval to supply the 29 plate heat exchangers used in the One Bryant Park skyscraper.

"Durst always tries to partner with people who are willing to innovate."

"The design of the frame and tightening bolts make the units more accessible," he says. "That alone cuts the maintenance time in half compared to the competitor's units we have in 4 Times Square [another Durst building nearby].

"When deciding on heat exchangers for the cogeneration plant, Alfa Laval was the natural choice," Winston continues. "At that time we already had decided on the other Alfa Laval units for our building.

"There is also the performance rating," he says, noting that ARI certification made the decision easier.

Winston is confident that the choices of manufacturers were the right ones, and the building is top of the line.

"We've done everything the best that we possibly could, within the normal constraints of commercial construction," he says. "We have executed this in the best way possible."

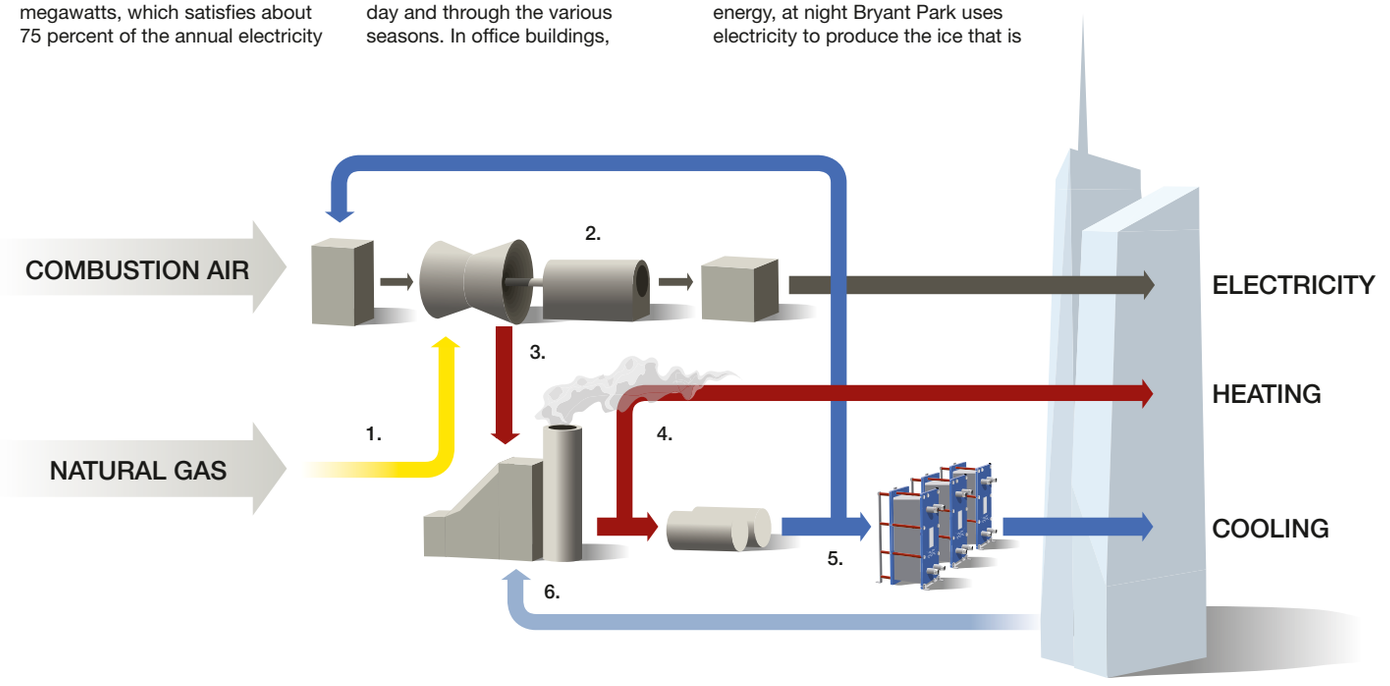
And getting there did not compromise Durst's building parameters, even with the stunning design.

"We had to tell the architects what we wanted," Winston says. "Does it improve the environment? Does it improve performance? And does it improve the quality of life for the occupants? That's what everything here is based on." ■

Cogeneration at One Bryant Park

One Bryant Park is to date the largest commercial office tower in the United States to use a combined heat and power (CHP) plant, also called a cogeneration system. It has a capacity of 4.6 megawatts, which satisfies about 75 percent of the annual electricity needs of the building.

CHP is more commonly used in industrial sites rather than in individual office buildings. Industrial sites have a relatively flat demand for energy over the course of the day and through the various seasons. In office buildings, however, demand is highly variable - high during working hours and much lower at night and weekends, making it challenging to get the most from a system's output. To balance the fluctuating demand for energy, at night Bryant Park uses electricity to produce the ice that is used to help cool the building during the day. Utilizing CHP, ice thermal storage and other conservation measures allow the building to significantly reduce carbon dioxide emissions. ■



1. Natural gas fires the gas turbine.
2. The turbine drives a generator that produces electricity.
3. The excess heat from the gas turbine is used to make steam.
4. Part of the steam is used for heating purposes, and part is used to drive an absorption chiller that produces chilled water to be used for cooling of the building.
5. Alfa Laval heat exchangers are used as a pressure break.
6. Condensate is returned to the heat-recovery steam generator to be processed again.

ILLUSTRATION: TOMAS ÖHRLING

A fresh approach to heat recovery

By the middle of this century our planet's population is expected to grow by 50%. At the same time, standards of living are expected to rise. This leads to increased energy consumption.

Alfa Laval is actively contributing to a more efficient energy use. Heat recovery in oil refineries is a good example. with traditional technology only about 70% of the energy is recovered. Our compact, fully welded heat exchangers enable a recovery of no less than 95%. Today we have several thousand heat exchangers of this type installed around the world. They don't just save energy and money. They also help reduce global carbon dioxide emissions by some 12 million tonnes a year. This equals the emissions from all the cars in sweden. Talk about putting energy into creating innovative solutions!

ALFA LAVAL

www.alfalaval.com