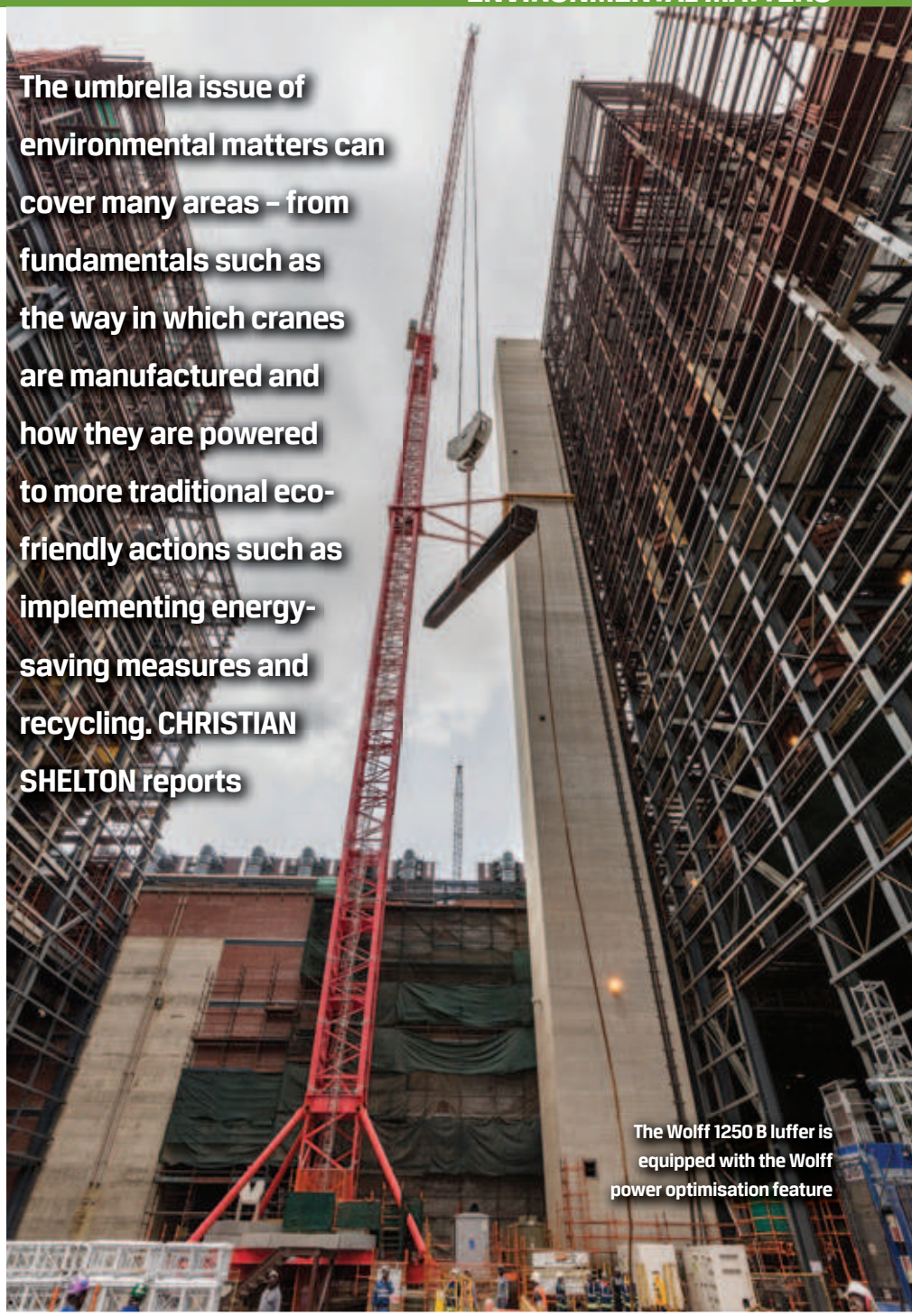
Going green

The umbrella issue of environmental matters can cover many areas – from fundamentals such as the way in which cranes are manufactured and how they are powered to more traditional eco-friendly actions such as implementing energy-saving measures and recycling. CHRISTIAN SHELTON reports



The Wolff 1250 B luffer is equipped with the Wolff power optimisation feature

In the last month, environmental matters hit the headlines in the UK with the news that the government plans to ban the sale of new petrol and diesel cars by 2040. It also revealed plans to spend £246 million ($320 million) over four years to fund research on batteries, as there is currently little capacity to store renewable energy in the UK. Although the government initiative is aimed at consumers, industry will surely follow suit. Henrik Henriksson, president and CEO at VW truck business Scania, commented recently, "As a company focusing on sustainability, we are pushing for renewable fuels – biodiesel, bioethanol, biogas. And here we see a strong demand coming not only from our customers but, even more encouraging, from our customers' customers."

A recent study, the *Non-road Mobile Engine and Aftertreatment Forecast* by consultancies Knibb Gormezano & Partners (KGP) and Off-Highway Research, looked at engine emissions across the diesel-powered construction, agricultural and materials handling equipment sectors. It identified an expected swing towards compliance with standards over the coming years. In 2013 more than 50 per cent of diesel engines fitted in new equipment globally met an emission standard of Tier 2 or less. By 2023 that proportion is expected to fall to just 4 %. Machines fitted with Tier 3 engines will be the largest part of the non-road mobile machinery market by that point, with significant numbers at Tier 4 Interim or higher. This includes Stage V engines, which will start to be fitted to new machines in Europe from 2019.

It is encouraging to see, however, that many companies in our industry are ahead of the curve. For example, Italian crane manufacturer Locatelli Crane says it abandoned the use of Tier II engine versions around ten years ago, even though they are still allowed in some countries. Since 2015 Locatelli claims to have been the first manufacturer to have adopted Tier IV Final engines on its complete range of rough terrain cranes. The company says that thanks to the use of the latest technology, its Tier IV Final engines are able to reduce nitrogen oxide and particulate matter emissions to the lowest levels ever for off-road machines without compromising the performance of its cranes. In addition, it says fuel savings of up to 20 % are possible compared to previous models. Locatelli says it has achieved this through optimising its cranes' hydraulics and control systems and via electronic management of the engine – an approach we will see a number of other manufacturers have also adopted.

Locatelli says it is working with its suppliers to develop Tier V engine options to offer solutions to its main customers in the contracting, rental and shipyard markets – as these are the areas it has found to be most concerned with environmental matters and minimising harmful emissions.

Engine efficiency features

Another company to optimise its drive and control systems to reduce fuel consumption and maximise the reliability and productivity of all its new duty cycle crawler cranes (HS-Series) and lift cranes (LR Series) as well as all piling and drilling rigs, is German crane manufacturer Liebherr. For example, all the company's Stage IV/ Tier 4 Final engines have a limited maximum speed of 1,700 min^{-1}; this, the company says, contributes to fuel savings of approximately five percent compared to previous engines.

Optimised hydraulic systems also enable the size of the crawler cranes' engines to be reduced without any negative effect on their productivity, says Liebherr. This way, it maintains, efficiency is increased and fuel »


Buying reconditioned engines helps reduce waste

consumption decreased. In the new Liebherr HS 8130 HD duty cycle crawler crane, for example, the engine power has been reduced to 505 kW compared to 670 kW in the preceding model.

Another efficiency-enhancing engine feature Liebherr introduced is a lower engine speed while idling. This is significant as Liebherr says that duty cycle crawler cranes can be in idle mode for up to 45 % of their operating time. It states this figure is closer to 60 % for crawler cranes. Liebherr claims that with the lowering of the engine speed from 950 to 750 min^{-1} while the cranes are in idling mode, up to two litres of fuel per hour can be saved. In addition, an automatic engine stop control switches the engine off during longer work interruptions, after having checked it is safe to do so. This, Liebherr says, saves fuel and reduces emissions. At the same time the cranes have fewer operating hours, thus increasing their residual value and extending their warranties and maintenance intervals.

Finally, an Eco-Silent Mode means the engine speed is reduced to a predefined, required level. Liebherr says this results in a notable reduction in diesel consumption without any impact on operational output. In addition, noise is also reduced by the Eco-Silent Mode.

Liebherr is keen to point out that environmental and economic interests can align. Crane buyers should consider low fuel consumption, longer service intervals, as well as a longer service life when buying a crane, it says, not only because these things are good for the environment but because they can save a considerable amount of money over the lifetime of the machine.

Power optimisation

German tower crane manufacturer Wolffkran has also implemented a number of power optimisation and control features to improve the environmental credentials of its electrically-operated tower cranes. For example, it says all drives are regulated by a frequency converter, making them more energy efficient than conventional electric cranes or diesel-powered cranes. The company also says that the hoisting and luffing gear it uses can achieve high working speeds with comparatively small motors. It says this is because the drives automatically adjust the power output so that full power is available at all times, increasing working speeds by up to 40 %. Comparable speeds using drives without this feature could only be achieved by using much larger motors which would mean a much higher consumption of energy, Wolffkran says. In addition, smaller motors have lower transportation and assembly weights. This also has a positive impact on the environment, Wolffkran says, by reducing fuel consumption and resulting pollution. The control and drive technologies are also installed in a single cabinet facilitating energy compensation between the drives, reducing the amount of power needed to operate them, Wolffkran says.

Load sensing controls

Wolffkran also makes full use of load sensing controls. For cranes fitted with hydraulic luffing drives, such as the Wolff 166 B, the load sensing control automatically adjusts the performance of the hydraulic pump to the required capacity. In other words, the system uses sensors to measures the load and then regulates the oil flow into the hydraulics as required, rather than continuously supplying the maximum amount of oil. Therefore, the Wolff 166 B only needs a relatively small motor with 22 kW – which requires less power than a larger motor.

Wolffkran also uses an automatic start-stop system. The cylinder that moves the jib of the 166 B is driven via a hydraulic unit. An electric motor drives the hydraulic pump and supplies the hydraulic cylinder with oil. With the Wolff start-stop system, the drive automatically switches off if the luffing gear is not being used.

Another company incorporating load sensing and power optimisation techniques to minimise the environmental impact of its loader cranes is Swedish on-road load handling specialist Hiab. One of the company's innovations is the electric power take off (ePTO) system for loader cranes. It's an electro-hydraulic system that is installed alongside the traditional engine-driven system that enables the crane operator to work with the engine switched off. When the loader crane is not in use, the electric pump automatically switches off to save energy and battery capacity. The crane uses an advanced load stabilisation system, LSS, to enable quick and easy crane operation, as well as a hydraulic system that cuts energy losses to a minimum, Hiab says.

Using electric power instead of conventional diesel power offers considerable benefits, claims Hiab, including improved energy efficiency, lower noise, and less environmental impact. It also means ePTO enabled loader cranes can be used indoors as no exhaust fumes are produced at the ppoint of use.

Hiab says the ePTO system means that the energy required to operate the crane is 60-70 percent less than that required for a conventional crane. The system comprises a lithium-ion battery, an electric motor, a hydraulic pump and a smart electronic control system all packaged in a stainless steel box mounted on the truck's chassis. A display mounted inside the truck cabin provides information about the current status of the ePTO, which can also be started and stopped via the display. Hiab says the system's battery has a capacity of 40 kWh, which is sufficient »


Hiab's ePTO system for loader cranes enables operators to just use electric power

for a normal day's crane work and that, because the system is so quiet, it can also be used in cities and residential areas at night without disturbing people sleeping.

Eco-efficient oil tank

Hiab has also developed a system for maximising the efficiency of hydraulic oil tanks for trucks. The system is called the Cyclone tank due to the use of a 'cyclone' to remove air from the hydraulic oil. Hiab says the cyclone principle allows for much smaller tanks, which means reduced weight and less installation space is needed. When using a 125 litre cyclone tank, a basic truck with an installed crane can save up to 600 kg a year in carbon dioxide (CO_2) emissions compared to a truck with a standard 300 litre hydraulic tank, says Hiab. This is made possible by the reduced weight of the smaller tank, which allows for more payload. Cost savings are also made possible due to lower hydraulic oil consumption, says Hiab.

Reconditioned engines

An eco-alternative to using optimised engines is the option of reconditioning engines. This is a service Belgian company Hamofa Industrial Engines offers. The company says it reconditions more than 900 diesel engines a year. Hamofa claims that the cost for reconditioning an old engine is several times lower than purchasing a new engine. It also says that, where possible, the reconditioning process reuses major engine parts, such as the block, crankshaft and cylinder head, which reduces negative environmental impact.

Crane designs

So far we have looked at the way in which cranes are powered and the optimisation of their drive systems; however there are many other approaches manufacturers are adopting to improve their green credentials. For example, Wolffkran says that all its cranes are constructed with a focus on keeping assembly times as short as possible.

The LCL700 luffing jib tower crane was designed with environmental criteria in mind, says manufacturer Linden Comansa

How does this translate into improved green credentials? According to Wolffkran, faster assembly means the time (and size) of the mobile cranes assisting in the assembly are in turn reduced, resulting in less fuel consumption. Wolffkran also claims that by speeding up assembly time road closures are kept to a minimum, thus reducing pollution from exhaust fumes. Wolffkran points out that many of its crane components come as pre-assembled units directly from the factory; for example, the Wolff patented hoisting gear design, which is incorporated in the tower top, has the hoist rope already pre-reeved in the pulley block – speeding up the assembly of the jib. Wolffkran adds that the patented design of the tower-top-counterjib unit of its luffers keeps the weight of individual components down, enabling smaller (and more environmentally friendly) mobile cranes to be used for the assembly.

Wolffkran also has a modular crane system to enable efficient utilisation of tower sections and cross frame elements (for the base). Since these components can be combined and easily adapted to suit different crane configurations, Wolffkran says there is less need to transport them back and forth between the yard and the construction sites, reducing fuel consumption and pollution. In addition, older cranes can be combined with new components so that there is not always a need to buy a completely new one, saving natural resources, says Wolffkran.

The company has also implemented additional features on its cranes to improve their environmental credentials. For example, the heater in the Wolff cab has a timer. Rather than running the heater all night to make sure that the windows are defrosted in morning, Wolffkran says the timer can be set to start heating in the morning, thus reducing electricity consumption. Finally, Wolffkran says its cranes are coated with environmentally friendly water-based paints with almost no solvents.

Another company that has been actively evaluating the eco credentials of its crane designs is tower crane manufacturer Linden Comansa. Linden Comansa also already uses mast sections that can be dismantled into flat panels to reduce the number of trucks or containers used during the crane's transport. It claims all of its tower cranes are designed to be easily erected, saving time and the fuel consumption of mobile assist cranes. It also uses high-speed hoist winches (called Effi-Plus) which offer improved efficiency so users reduce power consumption.

In 2015 the company adopted what it calls 'a procedure for the sustainable management of new projects'. The main

Hamofa Industrial Engines reconditions more than 900 diesel engines a year, thus helping reduce negative environmental impact

goal of this was to consider environmental criteria when designing new tower cranes without compromising either the price or the quality of the crane. This plan was followed in the design of the LCL700 luffing-jib tower crane, which Linden Comansa launched in February 2017. The company says this helped it reduce the waste of raw materials and use components or materials with less (or zero) environmental impact – not only during the manufacturing process but also when the life of the crane is over. The company also designed an optional soundproofing box for the crane to reduce the noise emissions of the hoist mechanism.

Offices and factories

There are also various ways in which companies are reducing their negative environmental impact at crane manufacturing facilities. For example, Linden Comansa created an internal energy efficiency group with the end goal of becoming an ISO 50001 certified company. Linden Comansa says the group works on different projects that allow it to progressively introduce new elements into its manufacturing to help reduce consumption of energy and other resources. For example, in 2016 Linden Comansa says it reduced its energy use by 14 % compared to 2015, despite working hours increasing by 22 %. This was achieved through a number of different actions, including: changing the lighting system to LEDs across a large part of the factory; adopting a new lighting policy across the entire plant; and switching off the fans in the painting tunnel during short breaks. This year Linden Comansa is looking at installing solar panels on the factory roof and recovering residual heat produced in its facilities.

US crane manufacturer Link-Belt says it has long been committed to environmental consciousness. The company claims it prescribes to a decision-making strategy of safety, quality, cost, delivery and environment. In addition to protecting the surrounding Bluegrass Region at Link-Belt's home in Lexington, Kentucky, the company »

says that being a responsible corporate citizen provides operational and financial benefits. Link-Belt's ISO 14001 registered environmental management system, part of the company's overall business management system, formalises this commitment and provides it with a strategic framework, the company claims.

Link-Belt has measured its progress toward meeting sustainability targets yearly. In comparing 2016 to base year 2013, Link-Belt says it reduced annual water consumption by 52 % (or 7.6 million gallons), annual office paper consumption by 29 % (or 772,500 sheets), and annual purchased material that is ultimately scrapped and must be landfilled or recycled by 39 percent, or 2,126,445 pounds 965 tonnes). A major reason for those results, it says, has been a company-wide campaign named Re-Think which is aimed at getting employees focused on reducing, reusing, and recycling.

Link-Belt also says it tries to encourage the reuse of products or materials. For example, it receives products from Cummins, AxleTech and Titan Wheel on returnable pallets. Link-Belt also uses plastic lumber in place of wood for landscaping and wagon cribbing, and donates items such as light fixtures, furniture, and cafeteria appliances to global housing charity Habitat for Humanity.

From 2014 through to 2016 Link-Belt says it diverted 12,020,226 pounds (5,452 tonnes)of material from landfill for recycling. "Link-Belt minimised hazardous waste, producing 28,874 gallons (7,900 litres) of recycled solvent through distillation in 2016," says Ken Johnson, Link-Belt supervisor of environmental and security management.

Link-Belt's Ken Johnson in front of the company's pervious car park in Kentucky, USA

"The company also has systems in place for recycling by-products like cardboard, metal, batteries, plastic banding, paper and wood. We have increased our recycling rate from 89 percent in 2013 to 98 percent last year." Link-Belt says its vision is to be the first North American crane manufacturer to have a zero landfill facility.

Carbon footprint reduction

Link-Belt is also seeing positive results in reducing its carbon footprint. The company says that in 2016 it was 24 % (4,290 tonnes) less than what it was in 2013. The company's strategy for reducing its carbon footprint looked at energy efficiency, starting with a computerised energy management system for monitoring consumption and controlling equipment. "The manufacturing facility's HVAC and compressed air equipment isn't needed 24-7. We are automating those utilities to operate when the work begins," explains Link-Belt facilities and maintenance manager, James Bowman.

Energy consumption has also been reduced by installing low wattage automatic lights and utilising high-volume, low speed fans for recirculating tempered air, and using exhaust air from large air compressors to supplement shop heating. Private office areas utilise a heat recovery type HVAC system that doesn't use a backup type heat. Open office areas are fed by a series of dual stage variable speed heat pumps and air handling units with natural gas back up heat.

Paint line process improvements have also helped reduce demand for natural gas, says Link Belt.

Finally, Link-Belt claims another significant improvement to its facility is a 27,500 square foot (2,555 square metre) pervious parking lot built in 2016. It stores approximately 25,700 cubic feet of water to greatly reduce storm water runoff.

A new wetlands and riparian buffer is also being constructed in the southwest corner of the property. A study is being made to identify other potential storm water best management practices. These projects are a joint effort between Link-Belt and the Lexington Fayette Urban County Government Division of Water Quality.

Link-Belt says its environmental management system extends beyond »

employees to onsite contractors who must communicate Link-Belt's methods to their employees to minimise impact and maintain compliance. Parts suppliers are asked to share environmental information about their operations and are invited to learn more about Link-Belt's. This, Link-Belt says, encompasses its dedication to manufacturing cranes with the latest diesel engine technology to reduce exhaust emissions and increase fuel efficiency. Link Belt says it was the first mobile crane manufacturer in North America to achieve Tier IV Final compliance across its product line.

Heavy lift specialist Sarens also reports a number of company-wide procedures designed to reduce its environmental impact. The company's 'safety, health, environment and quality policy statement', signed by CEO Wim Sarens in March 2017 states, "Our activities not only need to comply with the needs and requirements of the market but must also be implemented with respect for the environment. Sarens is committed to the prevention of pollution and therefore restricts the production of waste and emissions to a minimum; it takes measures to use energy and natural raw materials sparingly, and investigates alternatives to the use of hazardous substances."

Sarens has introduced the 'tulip' recycling bin into some of its offices to encourage recycling

Underscoring this statement of intent, Kleopatra Kyrimi, group marketing and communications manager, reports a tangible change in the state of mind of its employees towards considering the environment – an attitude that is fostered by Sarens.

For example, the company introduced 'tulips' – compact office bins designed to ensure that users sort waste in the proper manner – in its Belgium headquarters. It is now expanding this project worldwide. The number of wastepaper bins under employees' desks has been reduced and bin sharing is encouraged to make people consider exactly what they are throwing away. Signs around Sarens offices encourage employees to preserve energy and recycle. Even little actions, such as adjusting printer settings and using glasses instead of paper cups for drinking water, add up when multiplied by 4,180 employees and 60 locations worldwide, Kyrimi says. In India, Sarens has one switch that turns off all superfluous electrically powered devices, including the air-con, to simplify energy saving. Finally, Sarens' booming merchandising market will also be served by local factories around the world to reduce the impact of transportation.

"We might not work in a particularly green industry," concludes Kyrimi, "but it's not all black and white." Kyrimi is referring to the wider picture, in which the increasing number of renewable energy sector projects many crane and heavy transport users are involved with are key to constructing a more environmentally sustainable future. And with increasing regulations in areas such as carbon emissions and waste, coupled with a change in mindset at an individual level, it looks like the importance of good environmental practices will continue to be increasingly recognised. ■