MechChem AFRICA

MAY-JUNE 2020

CROWN PUBLICATIONS

This month:

- Rolling element bearings and how they fail
- Approaches to managing corrosion under insulation
- Finding wastewater solutions for Africa
- Specially-tailored solutions for sugar sector

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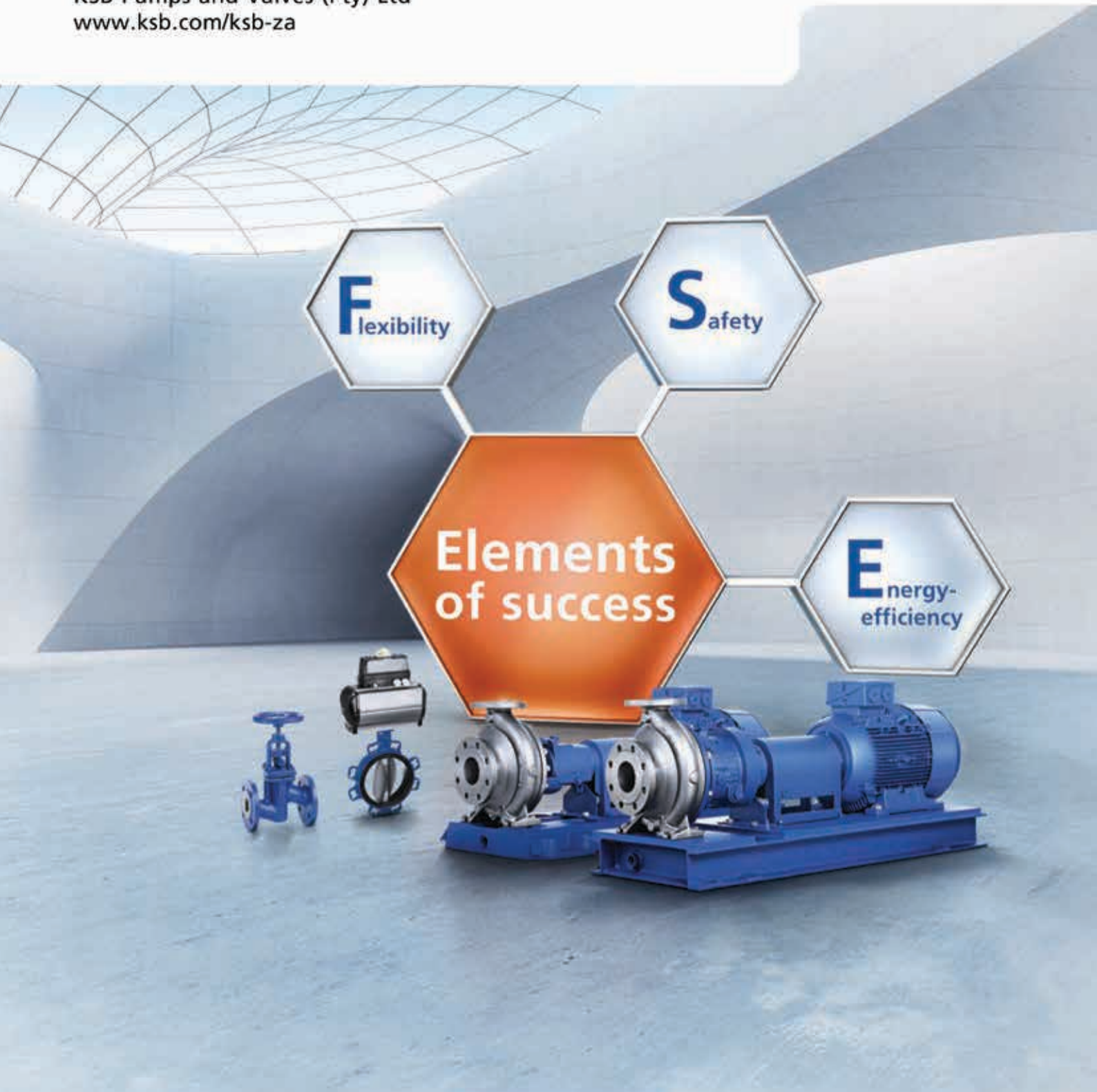

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Immortal genes, viruses and the ever-evolving new normal

Peter Middleton

COMMENT

Back in 1976, biologist Richard Dawkins wrote a book on evolution called *The Selfish Gene*, which popularised a gene-centred view of evolution, an alternative to Charles Darwin's hereditary view, where advantageous character traits of each species are passed down via reproduction variations.

Gene-centred evolutionary theory was originally outlined in 1907 by the philosopher Henri Bergson. *In Creative Evolution*, he wrote: "Life is like a current passing from germ to germ through the medium of a developed organism. It is as if the organism itself were only an excrescence, a bud caused to sprout by the former endeavouring to continue itself in a new germ."

I had to look up some of the language he used here: Bergson's 'germ' is not a microbial pathogen, he uses the word in the germination sense, where germ cells trigger the development of new life forms (organisms) or parts thereof. Perhaps today he may have used the word gene instead? Excrescence is another strong and emotive word: *'a distinct outgrowth on a human or animal body or on a plant, especially one that is the result of a disease or abnormality'*. A reference to evolution being driven by the abnormal?

A highly respected philosopher, Bergson was describing all humans, animals and plants as multi-generational life support systems for the genes they carry – and the biological purpose of all living things is to promote the development and survival of these genes.

Genes, which each carry pieces of information about the physical traits and make up of an individual, are found in the chromosomes at the nucleus of every type of cell – and both chromosomes and genes are made of the individual organism's unique DNA.

According to Dawkins, the genes referred to in the selfish gene model are "not just one single physical bit of DNA [but] all the replicas of a particular bit of DNA distributed throughout the world."

My simplistic understanding of the gene-centred view of evolution is that the mechanism involves competing genes, which seek to promote their own propagation in generation after generation of the life forms in which they survive. So the human race, along with the animal and plant kingdoms, are merely gene hosts, with all of our survival instincts and actions, both conscious and unconscious, being geared towards the long term survival of the strongest genes.

Genes too, though, evolve, via gene mutations or genetic recombination. Variations alter gene activity or protein function and introduce different traits in the individual host organism. If that trait is advantageous and helps the individual survive and reproduce, the genetic variation is more likely to be passed to the next generation and, over long periods of time, the population of the host organism may even evolve into a completely new species – with stronger genes that are more suited to their survival in new host populations living in radically different environments. The genes are not being 'selfish' in this, they are merely striving to be 'immortal', which Dawkins suggests is a word that better suits his book's core message.

Pathogens that cause diseases, such as bacteria, viruses and other microorganisms, are part and parcel of this gene-centred evolution. When a new virus such as COVID-19 penetrates a cell in the human body, it 'messages'; the cell's DNA/RNA to generate replicas. The cell itself is damaged in the process and usually dies, while the new copies of the virus are released and proceed to infect other similar cells.

But the immune response mechanism kicks in as soon as a problem has been detected, developing new ways to protect its cells, and these successful changes accumulate over time to better protect the genes from future attack.

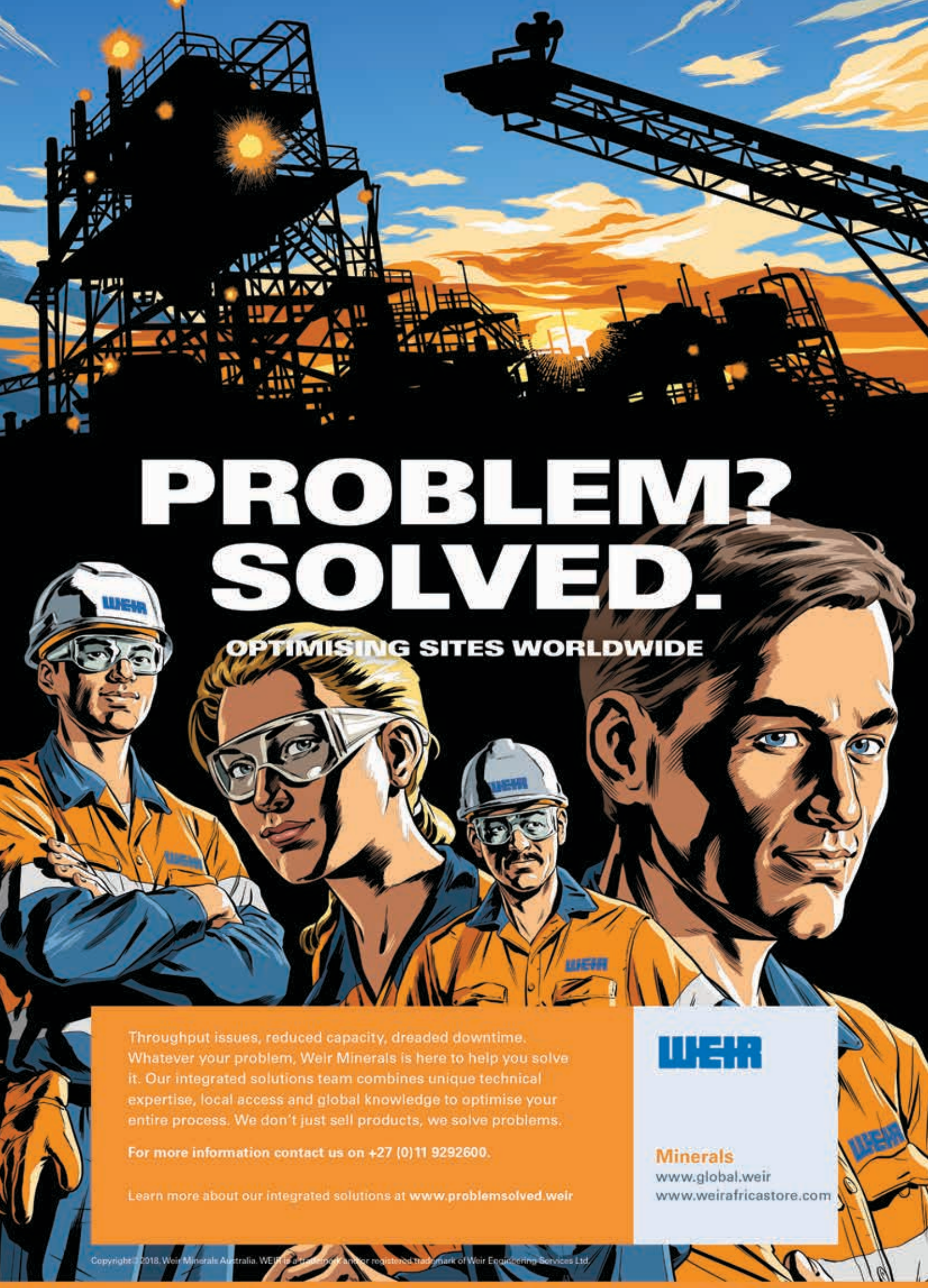
In a November 2016 paper entitled *'Our complicated relationship with viruses'* by geneticists Cedric Feschotte, Edward Chuong and Nels Elde from the University of Utah, the authors reported that nearly 10% of the human genome is made up of pieces of virus DNA, which are mostly not harmful and in some cases, beneficial. Benefits range from improving immune response against future diseases to evolutionary nutritional benefits, such as the ability to digest starch.

Stowaway sequences of viral genes, called endogenous retroviruses (ERVs), Feschotte hypothesised: "Were likely to be primary players in regulating immune activity because viruses themselves evolved to hijack the machinery to control immune cells."

While we all feel like we are living in unprecedented times and fear the world will never be the same again, virus infections such as SARS-COV-2 are not unprecedented. They have always been an intrinsic part of life and evolution, continuously thrusting new normals upon us.

In terms of our human response to this pandemic, let's seek out and embrace those elements of the change imposed upon us that might improve our future value and quality of life.

Let's steer the latest new normal towards a better one for everyone. ❑



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Maintenance, refurbishment and essential services for SA industry

Darryn Wright, marketing executive for ESG, part of Invicta Holdings and the division that manages and supports BMG, talks to *MechChem Africa* about the essential breakdown, maintenance and refurbishment services that remain available from BMG during the COVID-19 lockdown. "Not only is it critical to keep our essential industrial services up and running during the lockdown, we also need to ensure that we are ready to assist in turning the economy back on as soon as it becomes safe to do so," he says.

"As a customer-driven business, the BMG team remains committed to making sure that industry is able to continue operating as efficiently and as safely as possible during this difficult time. We are pleased to have been given permission from the Companies and Intellectual Property Commission (CIPC) to provide crucial engineering components and support, ensuring continuous operation of services throughout the country, albeit from selected BMG branches," says Wright. "We are determined to keep the wheels of essential industry turning and to help the people of our country pull through this crisis as painlessly as possible," he adds.

Among the industries that cannot be shut down during the COVID-19 crisis are food and beverage plants; water and waste water treatment facilities; coal mines and power stations; petrochemical plants and refineries; the sugar mills; ports and shipping industries and, of course, farms and agricultural industries – to all of which we provide product and services.

BMG, through its 'Boer Slim'/Smart Farming initiative, has been developing innovative ways of supporting South African farmers for several years, through sustainability solutions that focus on effective food production, the correct use of suitable equipment for specific tasks and the efficient application of advanced technologies. "This has never been more important. People locked inside their houses depend more than ever on fresh food being made available to them, and recent panic buying illustrates just how nervous people are. Farmers also need help to efficiently and effectively continue to produce through these difficult times," Wright argues.

BMG's high-quality replacement agricultural components are engineered to improve productivity in the farming sector, to operate efficiently for extended periods with minimal maintenance requirements, and to reduce costs in the long term. BMG's electronic, fluid technology, tools and power transmission components have been carefully selected to deliver smarter solutions on farms that enhance productivity and energy efficiency.

New to BMG's range of agricultural components are slogging hammers and wheel sloggers, used to loosen and tighten bolts and nuts quickly and easily; BTC gearboxes, specifically designed for packhouses and Motoline solar inverters for photovoltaic (PV) water pumps. Dual direction multi-purpose gearboxes, PTO clutches and specially designed heavy-duty coulter bearings are also new to the range.

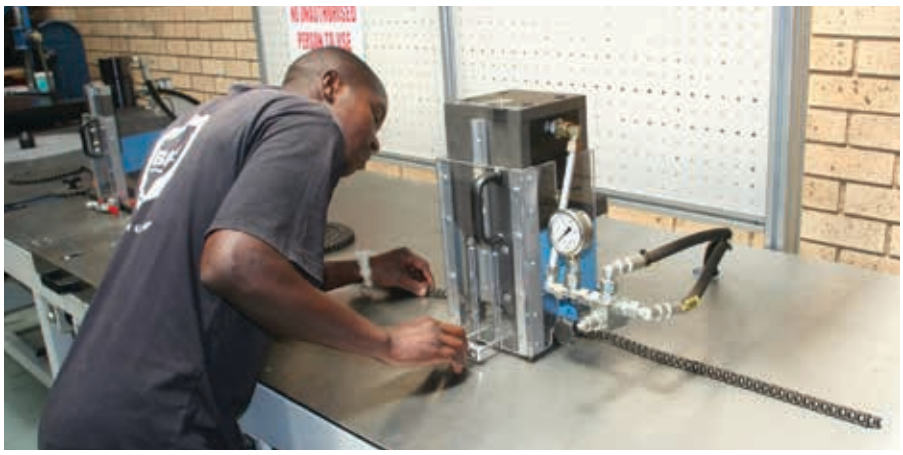
BMG engineering support offering to essential service providers includes bearing and gearbox inspection and refurbishment and large size bearing repair, assembly, alignment and balancing.

From a water perspective, BMG specialists with technical knowledge and extensive experience in water engineering play an important role in upgrading ageing water and wastewater facilities and designing new drive systems to ensure a dependable infrastructure. Critical is the selection of robust equipment, which can endure continuous operation under severe conditions. "People cannot be locked in for long without fresh water, so it is absolutely vital for our water specialists to be available to deal with unexpected breakdowns quickly and effectively," Wright continues.

BMG also works closely with the food and beverage sectors to raise hygiene standards throughout the food and logistics chain – from farmers, processors, manufacturers and packagers, to distributors, retailers and consumers. "Our solution services help the local food and beverage sector deliver on food safety and environmental and energy-efficient initiatives by supplying and supporting components for light materials handling, belting products, gearboxes, motors and variable speed drives (VSDs), seals and bearings, power transmission components, valves, tools and equipment, as well as fasteners, food-grade lubricants and maintenance chemicals," notes Wright.

Essential services

As well as the supply of the components, accessories and spare parts necessary to maintain critical equipment, BMG is able to offer both delivery and field services to customers in need of urgent assistance. "Our field



Specialist services include attachment chain refurbishments and repair.

Keeping assets such as overland conveyors healthy while the country is on shutdown is vital, particularly for coal mines servicing our power industry.

BMG engineering support technicians replace the drum drive and rake drive gearboxes on a reclaimer. BMG's field services offering was set up to deliver mobile breakdown, repair and maintenance support, and this is the current go-to service for clients needing to get up and running as quickly as possible following a breakdown.

services offering was set up to deliver mobile breakdown, repair and maintenance support, and this is our current go-to service for clients needing to get up and running as quickly as possible following a breakdown.

Citing a recent example in the sugar sector, Wright tells of a turn-key in-situ replacement project involving a diffuser head shaft bearing and the complete refurbishment of the multi-misalignment couplings driving each end of the head shaft. "This had to be done during the off-crop season so careful planning and project management were essential to ensure the work was completed in the time available," he points out.

Breakdowns in plants such as sugar mills and oil refineries are also routinely handled by BMG's field services units. "Our field services and onsite technical personnel are well qualified to cope with the tight timeframes involved to manufacture replacement components and complete the necessary onsite installation, which also often involves the installation of new bearings and adaptor sleeves, as well as new keys and connector arms for couplings. BMG's field service teams also attend to failures such as mill gearboxes, where seized coupling boxes cause excessive axial loading on the final drive bearings, resulting in bearing failures," Wright explains.

Other specialist services to the sugar sector include bearing and gearbox inspection, bearing and chain refurbishment, large size bearing assembly and alignment and balancing, as well as customised product design. BMG also offers a trouble shooting and maintenance service, condition monitoring and training.

BMG's integrated engineering solutions for the mining sector include a complete electromechanical capability, which comprises customised plant design, product selection, installation, commissioning and support service. "Energy-efficient drive solutions are designed to meet the exact needs of mining and mineral processing, at the same time ensuring improved asset availability and the lowest cost of ownership.

"Keeping these assets healthy while the country is on shutdown is vital, particularly for coal mines servicing our power industry, but they will also be essential to enable our mining industry to ramp up quickly as soon as the crisis starts to ease," he suggests.

Technical resources

BMG's technical resource centres offer services that positively influence the operating efficiencies of South African industry by ensuring maximised mechanical reliability of plant and machinery. The technical resources team partners with each customer to ensure dependable solutions – from the initial design concept, specification, manufacturing quality control, commissioning and support of equipment in use. Services include technical applications consulting, product and system design, on-site process analysis, lab and on-site oil analysis, product quality control and assurance, as well as condition monitoring services.

"We also have Regional Service Centres (RSCs) that play a critical role by providing engineering solution services to key industries, including sugar, agriculture, shipping, mining, automotive, power and petrochemical plants, manufacturing and general engineering. These specialist service centres – with assembly, repair, maintenance and support operations – offer a combined technical expertise and value-added product solutions to further strengthen the company's service offering," Wright continues.

Advantages for customers include improved service, repair and delivery efficiencies, centralised technical support and easy accessibility to BMG's comprehensive range of quality branded engineering components.

BMG's RSCs also have mobile field services teams that can conduct breakdown and routine maintenance on plant, carry out trouble shooting and advise on possible productivity improvements, both to overcome immediate difficulties and to secure ongoing high levels of plant output and reliability.

Specialist services include installation, adjustment, replacement and maintenance of components, shaft and pulley alignment, balancing, condition monitoring, oil sampling and analysis and critical equipment inspections and lubrication schedules. Maintenance training and fault diagnosis also form an important part of BMG's regional services offering.

"BMG has secured exclusive supply, service and distribution agreements with some of the world's most respected manufacturers of leading engineering components. Our products are carefully selected in terms of consistent quality controls, compatibility, standardisation, reliability and extended service life. In addition, our state-of-the-art warehouse and distribution facility at BMG World in Johannesburg reflects the company's ability to quickly supply these world-class solutions to diverse industries throughout Africa.

"For the duration of the COVID-19 crisis, our brave and committed technical support and field services teams are on hand to assist our essential service customers in any way we can. Anyone requiring assistance can contact BMG on our emergency number: 0800 022 224," Wright concludes. ❑

Bosch Rexroth SA steadily implements Africa Strategy

MechChem Africa talks to Tillmann Olsen – regional president for Africa and CEO of the Bosch Rexroth SA Group – about the company's Africa Strategy and the initiatives being put in place to increase the Group's footprint on the continent.

Following the decision to invest directly in the Hytec Group of companies some eight years ago, Bosch Rexroth is well on its way to realising its Africa strategy.

"Bosch Rexroth has been in partnership with the Hytec Group for over 50 years and, back in 2014, this drove our decision to make a direct investment in the company," Olsen tells *MechChem Africa*. At that time, Bosch Rexroth took a 50% stake in the Hytec Group of companies, which was fully consolidated on March 1, 2018 when Bosch Rexroth acquired the remaining 50% of Hytec.

Underpinning the decision was a recognition by the company's German parent that Bosch Rexroth hydraulic and pneumatic products and solutions were under-represented in a growth market like Africa.

"We recognised from the start that the Hytec business model had already enabled penetration into many African countries. Our European model mostly involves the mass production of components, which are then sold into OEM operations. The Hytec business model is an end-user driven business: delivering engineered solutions for end-user needs. The partnership has enabled us to retain and grow this model across the continent, using Hytec's expertise on the ground coupled with Bosch Rexroth's unparalleled hydraulic and automation technical expertise and product knowledge to deliver custom solutions to different regions of the continent," Olsen adds.

"We also took the deliberate decision to keep the Hytec business model and expand it across Africa. Hytec had already become strong in Namibia, Botswana, Zambia and Mozambique but, as well strengthening these operations, we have since added Ghana in West Africa, Kenya in the East, and Morocco in North Africa to our Africa network," he says. "We believe that for engineering companies to run operations efficiently, they must be able to put expertise onsite. We strive to put the right skills set in the right place to add value to our customers' operations."

He says that engineering 'heavy lifting' can be done remotely once a problem is fully analysed and understood, but longstanding expertise and an understanding of the operating conditions and the application are essential for implemented solutions to be effective in the long term. "So we strive to create the local expertise to service the mining industry in Ghana; the growing mining, construction and automotive sectors from our base in Casablanca in Morocco; and for the fast moving goods manufacturing industries in Kenya," he says.

In addition, Olsen reveals that local partners have been appointed to take Bosch Rexroth expertise forward in The Democratic Republic of Congo and in Tanzania. "These are not our own legal entities, but we are fully enabling our partners by transferring technological and product knowledge, while fostering good relationships that are mutually beneficial. Africa is massively diverse with respect to culture and this impacts the business landscape. To supply into these markets, one has to have a local presence that can penetrate the cultural barriers," he suggests.

"Fortunately, Hytec was already on this solution path and there was no need to reinvent the wheel. Bosch Rexroth Group ownership adds some gravitas, though, and enables

In Ghana, Bosch Rexroth recently installed a pump and motor test bench to enable the company to offer similar capabilities to those available in the Rexroth HUBB in Kempton Park, South Africa.

representatives across Africa to leverage off the bigger footprint and the engineering expertise, from here in South Africa and, if we can't help, from anywhere out of the global Bosch Rexroth network," Olsen informs *MechChem Africa*.

Another important aspect of the strategy is skills and knowledge transfer. "Our own staff and partners are learning their trade and developing the service expertise needed from very experienced colleagues from all over the world. If a technician can't repair a pump, he or she comes down to South Africa for highly practical training from experienced professionals. They can then go back and multiply that knowledge, passing it on to other local colleagues. In this way, the network of skilled professionals in every branch can continue to grow," Olsen explains.

In South Africa, we offer externally approved and Merseta accredited Hydraulics and Pneumatics courses for service providers from all over Africa. In addition, we are able to develop and deliver specific training modules for customers, based on the needs of their local installations," he continues, adding that in these cases, a trainer will travel out to do training on installed equipment with a view to filling skills and knowledge gaps of onsite maintenance personnel.

"Often, when big companies swallow up small to medium sized companies, the corporate mentality dictates how to do things and doing business the 'old way' starts to become complicated. We have deliberately avoided going down that route and, instead, have adopted the Hytec way. For Bosch Rexroth, this is exceptional, but it recognises the excellent value-driven and zero tolerance to corruption culture created by the Hytec Group.

"The approach is also very flexible in terms of the type of services offered and the solutions provided," he notes. "This includes the representation of more than 20 world-renowned brands that the Hytec Group offered before the acquisition and which we continue to sell into the market as components and elements of the integrated solutions we install," Olsen tells *MechChem Africa*.

Praise indeed from an employee with over 20 years of experience of the Bosch Rexroth way.

The end result is a steadily growing African footprint and increasing numbers of skilled people. "In Ghana, we have recently installed a pump and motor test bench and a cylinder stripping and testing bench so we can test strip and repair hydraulic systems and cylinders onsite. And we are replicating these kinds of capabilities wherever we feel there is a need.

"Much of our business is traditional,' he continues, "but we are slowly seeing some smart technologies being incorporated into local applications, mostly the incorporation of sensors and some connectivity solutions to help detect problems sooner and to reduce human error.

Bosch Rexroth believes that for engineering companies to run operations efficiently, they must be able to put expertise onsite.

Bosch Rexroth's large cylinder stripping and testing bench at its Hytec Engineering premises in Spartan, South Africa. A similar unit has now been installed in Ghana for local testing, stripping and repair of hydraulic systems and cylinders.

"For Africa, this involves a two-pronged approach. New products already come with built in sensors. Getting a reading from the component when it is down a mine, though, doesn't happen overnight. Some sensors cannot easily be retrofitted, so if they are at least installed, then once investment in a network becomes viable, we can easily connect to the component and start taking readings. It's like having the future built in from the start," Olsen says.

"We are customer obsessed. We continually strive to deliver solutions that add value to customer operations, via lower maintenance costs, less downtime or improved productivity. And our strategy is to do this by standing beside our customers wherever in Africa they need us. We move, you win," Olsen concludes. ❑

Bosch Rexroth modular hydraulic power units are used to drive hydraulic systems across Africa.

Mark Bannerman.

Innovative enterprise asset management in 2020

In a digital world it is critical that industries move beyond traditional asset management, and in 2020, it's time to embrace predictive analytics to strategise capital investments more effectively.

Managers responsible for asset maintenance – whether in a factory, utility or public facility – are often forced to fill multiple roles, from supervising repairs and preventive maintenance to inventorying assets and projecting their lifespan. As digitalisation sweeps through industries, balancing the multiple pressures of the job can be difficult.

Digital concepts rely heavily on equipment upgrades, such as adding sensors and IoT connectivity, pulling decision-makers in multiple directions. Analysing capital needs and prioritising investments can be a time-consuming burden for teams already thinly stretched. Fortunately, technology can help.

"Asset management plays a critical role in the digital revolution," says Mark Bannerman, managing director: Infor services at iOCO. "Network connectivity, machine learning, Internet of Things and Artificial Intelligence are just a few of the innovative technologies transforming industries. Although these technologies are largely software-driven, they also rely on equipment and machinery updates, such as embedding sensors and adding robotic arms. These machinery upgrades all require capital."

Asset managers are able to take a more holistic approach to their asset management and recommendations if they can view the big picture.

Bannerman advises considering an alternative option in 2020. He says, instead of looking only at the investment part of the equation, asset managers will take a more holistic approach to their recommendations if they can view the big-picture - from Facility Condition Assessment (FCA), to Remaining Useful Life (RUL) and Estimated Replacement Cost. "The recent as-serviced history, costs of asset maintenance and any service contracts or warranties must be considered," he adds.

In most enterprises, the cost of unexpected downtime associated with upgrade-vs-replace decisions is a common factor. The ultimate question is, 'What investment options will provide the most expedient resolution, the highest level of reliability, and the least amount of disruption to operations'? The other big issue at stake is cash flow. Not only should the capital needed for the investment be considered, but the impact on personnel and any interruption to fulfilling customer needs should also be considered.

"An advanced Enterprise Asset Management (EAM) solution paired with robust analytics will provide the required type of broad

Critical fuel service under COVID-19 lockdown

Reef Fuel Injection Services has been granted Essential Service status ensuring critical industries can rely on the company should they experience diesel fuel injection system issues during lockdown.

Reef Fuel Injection Services can assist with all mandatory maintenance as well as unscheduled breakdown requirements for customers operating in the distribution and transportation, mining, power generation and agricultural sectors.

Significantly, Reef Fuel Injection Services is an authorised service agent for all leading manufacturers of diesel fuel injection systems including Bosch, Delphi, Denso and Stanadyne, and offers OEM approved and warranted testing as well as quality remanufacture and calibration of all these systems.

An important advantage for many CAT equipment operators is that Reef Fuel Injection Services operates a fully-fledged field service team that can conduct comprehensive diagnostic testing and remanufacture and calibrations services while on a customer's site. ❑

Critical industries can rely on Reef Fuel Injection Services for reliable fuel injection system repairs, mandatory maintenance and unscheduled breakdowns.

perspective. This is preceded by conducting an asset assessment. While this may take some investment of time up-front, the rewards will pay off," says Bannerman.

The first step is capturing data around the critical nature of the asset or the 'value' to the organisation. That means more than replacement costs. For each asset, managers should also note whether the technology is considered 'modern' or if it has become outdated and is lagging behind current industry standards.

The second step is developing the ability to monitor each asset and track performance issues. This will contribute to sound financial planning. This empowers users to search the system for assets which need preventive maintenance and make sure the necessary parts and resources are available, while estimating those costs.

Bannerman believes that the most significant value will come from the power of predictive analytics. Today, innovative Business Intelligence (BI) solutions can contain powerful predictive capabilities, using algorithms and data science to identify patterns in data points and project next likely outcomes. Users can explore 'what if' scenarios and obtain cost and demand forecasts.

"This glimpse of future investment needs can be evaluated against projected cash cycles – taking into account forecasts for customer demand. Managers can then prioritise major investments, when funds will be available, and plan for stop-gap, bare-minimum fixes during lean periods. All this while identifying time-sensitive critical issues that are high priority and demand immediate response," he says.

Innovative Business Intelligence (BI) solutions can contain powerful predictive capabilities, using algorithms and data science to identify patterns in data points and project next likely outcomes.

The reporting generated by the EAM solution, paired with advanced analytics, allows asset managers to consolidate needs across departments or business units and negotiate for possible economies of scale or bulk purchasing. "With the view into future demands and future capital available, asset managers can make well informed recommendations. Top priorities and critical needs can be considered along with potential gains and benefits. Smart investments will yield success in 2020 and beyond," Bannerman concludes. ❑

Rolling element bearings and how they fail

In this issue's Failure column, Tim Carter talks about how bearings fail and discusses some common maintenance practices that must be stopped if reduced bearing life is to be avoided.

Rolling element bearings are of two types, cylindrical roller bearings or spherical ball bearings.

Our built environment moves on rolling element bearings. Without them, we would be lubricating the bearings of our ox-carts with animal fat. The upside, if it can be so described, would be that speeding tickets would have never been invented, though it would take a little longer to get to the office.

Whilst we still use plain bearings in some applications such as on crankshafts, just about everything else that moves, moves on rolling element bearings, which can be fragile and hard to work with. Try replacing the bearings on a rolling element bearing crankshaft and you'll know what I mean. Long ago, my various motor-cycles (BSA, Triumph) used them and they were a real pain to work on. The Bugatti motor car (the real one, not the one that's on the market now) had them too.

Rolling element bearings were considered so important during World War II that the Allied air forces were prepared to sacrifice several dozen aircraft and their crews in an attempt to destroy the Axis' capability to make them by destroying the factories at Schweinfurt.

Rolling element bearings are of two types, characterised by the shape of the elements that roll. These are either cylindrical rollers or spherical balls and are known, unimaginatively, as roller bearings and ball bearings.

All rolling element bearings eventually fail by fatigue in a mechanism called, with equal lack of imagination, 'rolling contact fatigue' – provided some other mechanism doesn't get to them first, that is.

Tim J Carter is a consulting physical metallurgist previously in private practice and now with ImpLabs in Benoni: timjcarterconsulting@gmail.com.

Rolling element bearings are reliable and tolerant of abuse; but only up to a point. They require a flow of clean lubricant, firstly to keep them cool and secondly to flush away the wear debris that is produced in normal operation during the life of the bearing and capture it in the filtration system. Slower bearings, like the wheel bearings on your car, don't need cooling and can get away with grease lubrication. They can even be 'sealed for life', depending on how long you expect the life to be.

The life of a rolling element bearing can be divided into three stages.

When first installed, contact between the elements and the raceways in which they run –which carry the original manufacturing machining marks left when the elements and the raceways were ground – will burnish the surface. The machining marks disappear and the contact surfaces become bright and shiny. After a long period, the contact surfaces start to become duller as the surfaces start to wear, usually through contamination of the lubricant with debris and dirt that is too fine to be filtered out.

When a bearing looks grey on the contact surfaces during a normal periodic inspection, it's time to make sure there is a spare in the stores, and to pay special attention to the results of lubricant analysis and wear debris analysis program reports. These will indicate when the end is close and the worn bearing needs to be replaced. Rolling element bearings can sometimes be re-furbished by re-grinding the raceways and fitting larger rolling elements. But it's not a common practice and normally not cost-effective.

The last phase of the life of the bearing begins when sub-cutaneous stresses resulting from the passage of the rolling element over the raceway initiate fatigue. The surface, whether of the rolling element or the raceway, will begin to spall and release distinctively shaped debris into the lubricant. That's what the analyst is looking for in a routine examination of the lubricant.

Gears, where the teeth roll over each other in operation, suffer from the same problem, which is why manufacturers of rolling element bearings and high quality gears pay special attention to the cleanliness of the steel they use. Rolling contact fatigue usually initiates at sub-surface non-metallic inclusions. If they are eliminated, or mostly eliminated, by using very 'clean' steels, the life can be greatly extended. Some manufacturers of bearings go to the extent of operating their own steel manufacturing facilities so they can control their steel quality.

There are ways of destroying a rolling element bearing other than by rolling contact fatigue. Subjecting a bearing to impact loadings will cause the rolling elements to indent the raceway surface, a phenomenon known as 'brinelling', and will cause failure. The most common cause of impact loadings is incorrect installation, sometimes with a hammer, transmitting the installation loading through the bearing itself. Don't do it, and don't let anyone else do it.

Also, allowing a bearing to vibrate whilst stationary – for example, in a stand-by pump mounted on the same base as the operating pump – will cause local wear known as 'false brinelling'. Don't do that either. True brinelling or false, the effects are the same, the life of the bearing is compromised.

Passing an electric current through a bearing will cause arcing in the gap between the rolling elements and the raceway, leading to the formation of micro-cracks, which reduce the initiation time for fatigue from around 80% of bearing life to zero, resulting in very premature failure. The electricity can come from a number of sources. In an aircraft propeller, it can be gathered from an electrically charged cloud formation. In a machine tool, it can come from a poorly earthed connection or a nearby welding operation. Either way, it will ruin the bearing.

A common way of ruining a bearing is to clean it with compressed air, while allowing the bearing to spin. It will probably be rotating faster than it was designed to, and without lubricant. Plus, if you drop it while it's spinning it will shoot all over the shop. With the bearing held stationary, compressed air is fine and works well. Rotating ... again, don't do it. ❑

Crankshaft for Cummins QSK 78 diesel engine gets a turn

Metric Automotive Engineering is currently remanufacturing a crankshaft belonging to an 18-cylinder Cummins QSK 78 diesel engine. The large engine is working under arduous operating conditions, powering a rigid frame dump truck in an open cast mining operation.

A crankshaft belonging to an 18- cylinder Cummins QSK 78 diesel engine being remanufactured at Metric Automotive Engineering.

Andrew Yorke, operations director at Metric Automotive Engineering explains that the engine components, because they had reached their scheduled overhaul hours, had come into the facility for assessment and remanufacturing to meet OEM standards.

The 2.7 m long, 4000 hp diesel engine – with components including the crankshaft, camshaft, conrod, block and heads – arrived at Metric Automotive Engineering's well-equipped facility and was accommodated on the company's crankshaft polishing machine, where it was cleaned using specialised high-pressure steam and ultrasonic cleaning processes.

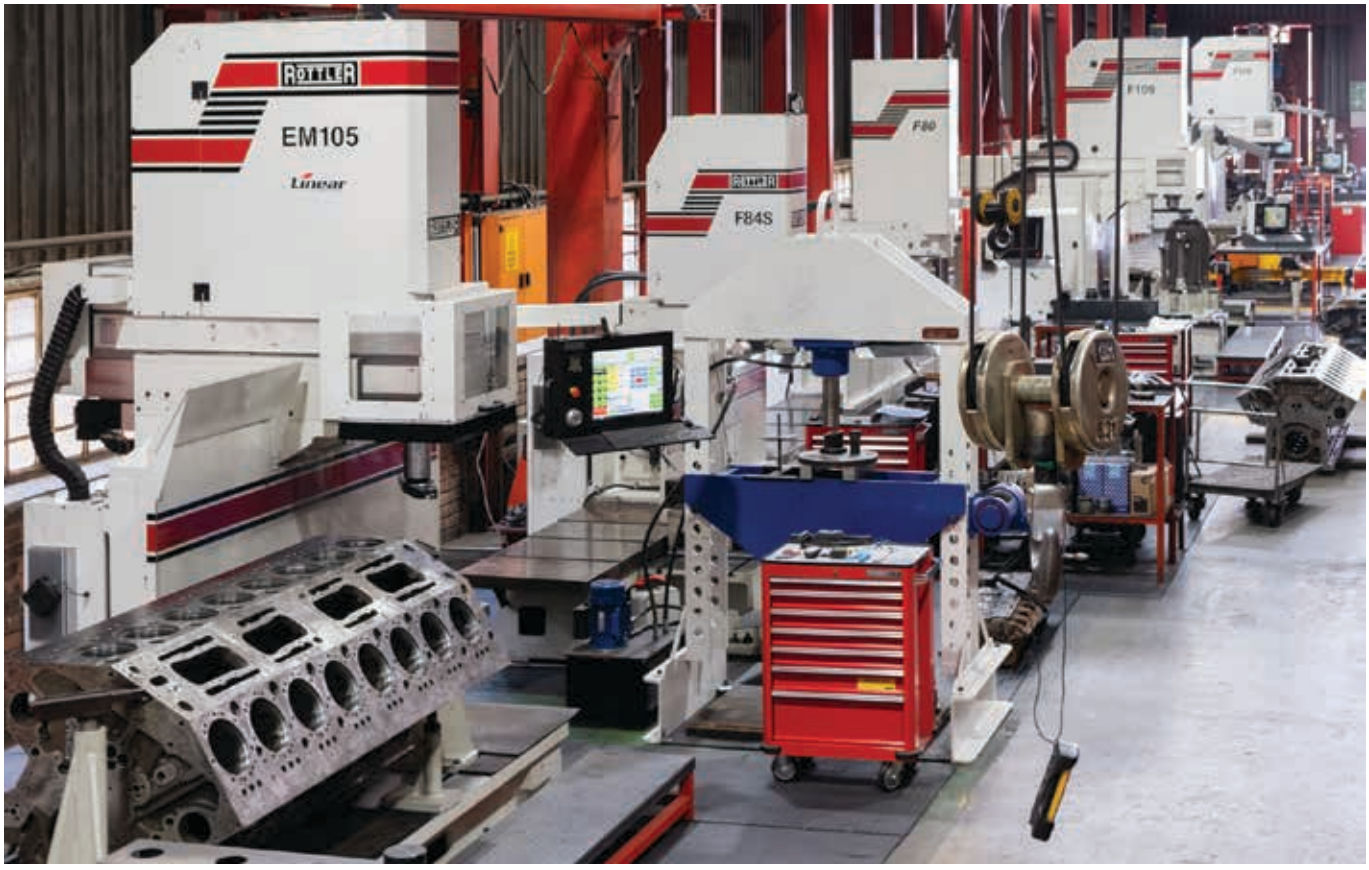
"Cleaning is vital to facilitate visual inspection and, following this, components are sent to the dedicated component sections at our facility where a skilled automotive machinist conducts a full assessment on the integrity of the component using OEM specifications and guidelines," Yorke says.

In this particular instance, the crankshaft integrity was favourable and the component only required surface polishing of the journals. Yorke says this a great example of an effective lubrication filtration system and scheduled preventative maintenance helping to reduce long term operating costs by preventing wear and damage to the crankshaft. It results in a less costly remanufacturing process to return the crankshaft to OEM specification.

"Metric Automotive Engineering has a comprehensively equipped remanufacturing facility which can handle large diesel and gas engine components with ease. Competent technical personnel receive ongoing training and development to ensure they are kept abreast of the latest technology. ISO driven quality standards and a high level of accountability ensure that customers receive remanufactured components that meet and often exceed OEM specifications," Yorke explains.

Speaking about the effects of the global shutdown due to the COVID-19 pandemic on the company, Yorke adds that the company is committed to supporting customers who are providing essential services during the current lockdown restrictions, while still meeting the required safety regulations.

"We have been granted Essential Services status and are fully operational with a reduced staff complement. Companies that have been declared an essential service need to know that their own support services are fully operational and ready to ensure they stay on track. This includes all those in transport logistics from vehicles moving essential items such as foodstuffs and medical equipment through to the mining and power generation companies," Yorke concludes. ❑



Metric Automotive Engineering is committed to supporting customers who are providing essential services during the current lockdown restrictions.

Laboratory experts take sampling to new heights

With the general decline in ore grades in mining, FLSmidth's market-leading expertise in mineral sampling and laboratory automation holds increasing value to mines.

"The more you understand about the characteristics of the ore entering your process plant, the better you can treat it," says Martin Matthysen, director, SPA (sampling, preparation and analysis), Sub Saharan African and Middle East at FLSmidth. "But this needs technology that can sample high volumes, maintain rapid turnaround times, and deliver quality results."

Only then can plant operators respond to laboratory data in real time, which is one of the keys to effective plant optimisation. With over 30 years of experience, FLSmidth has been a pioneer in laboratory systems integration, as well as driving automation in the laboratory environment.

"Our particular expertise in laboratory automation is now recognised world-wide," says Matthysen. "This is why we have supplied 95% of all automated laboratories to the global mining industry constructed over the past dozen years or so."

The company's offerings address all stages of mines' sampling and analysis requirements. It designs solutions for exploration and ore characterisation, grade control, process plants and port shipment. The highest quality equipment is sourced and applied to a laboratory solution to achieve accurate sampling, effective sample preparation and detailed sample analysis.

Each laboratory design is unique, he emphasises, as it must suit each customer's particular operating conditions and strategic goals. The design process therefore demands close collaboration with the customer and a detailed examination of mined material and process demands. This ensures that the laboratory generates exactly the type of analytical data that the plant operators require.

"With our world-class mineral research and testing facilities, we are constantly pioneering innovations that add value to customers," he says. "Our automated solutions also offer consistency and traceability, while improving ergonomics and eliminating hazards to laboratory personnel."

Among the company's innovations has been an environmentally-friendly methodology that replaces traditional wet chemistry. With no acid being used to dissolve platinum ore, for instance, the process produces no toxic waste – dramatically reducing the impact on the environment.

"We are accredited in terms of international quality standards, and work strictly

State-of-the-art automated zinc laboratory at Vedanta's Gamsberg Mine.

Above: *Automated drying of solid samples.* ***Left:*** *Physical analysis including particle size, density and moisture content.*

to our customers' stringent specifications regarding health, safety and environment," he says. "Our expertise gives customers the confidence not only to procure laboratories from us, but increasingly to contract us to maintain and operate those facilities on their behalf." ❑

MBE Minerals' screen footprint grows across commodities

Leveraging decades of industry experience and its in-house design expertise, MBE Minerals has delivered 15 new screens to mining customers in the coal, diamond, iron ore and manganese sectors, strengthening its footprint of vibrating screens across a wider range of commodities.

These operations, which are based in South Africa, Botswana and Australia, will benefit from MBE Minerals' expertise says sales manager Graham Standers. MBE Minerals has also fully refurbished a further four screens to 'as new' condition as they approached the end of their planned lifecycle.

"We place high priority on design capacity to ensure that every screen suits the application and material it must screen," says Standers. "Five of the screens supplied were newly designed to suit changing customer needs and processes."

Each screen is designed by the company's design office, and the design is then confirmed by Finite Element Analysis (FEA) through highly specialised software using data from the drawing model.

"We have also introduced a range of screens designed specifically for fine coal dewatering, using a design that has proven to be cost effective, efficient and reliable," he says. "Focus was placed on the design of the screen deck support system and screen drive, with a view to reducing downtime by minimising maintenance and enhancing reliability."

The design is efficient in terms of the required spares stockholding, further reducing the screen's overall lifecycle costs.

"Our T-Lock pinless panel fastening system for polyurethane screen panels also significantly reduces the need to hold spares in stock, and reduces the change-out time for screen panels," he says.

Technical and sales staff conduct regular on-site visits to customers to carry out inspections of equipment in operation. The teams report on equipment condition and performance, and provide customers with value-adding feedback and advice.

MBE Minerals – previously known as Humboldt Wedag – has been designing, manufacturing, installing and servicing vibrating screens in southern Africa for over 40 years.

"Our record for reliability is well known, with some of our units having been in service for over 20 years," concludes Standers. ❑

Final assembly of an MBE Minerals dewatering screen.

Test run on an MBE Minerals dewatering screen.

Ultra-high capacity bulk bag filling system

A new sanitary bulk bag filling system from Flexicon features dual SWING-DOWN™ fillers fed by high capacity weigh hoppers, achieving fill rates of up to 40 bulk bags per hour.

The patented filler design simultaneously lowers and pivots each fill head into a vertically-oriented position that places the inflatable spout connection collar, inflator button, and four bag loop latches within reach of an operator standing on the plant floor. This significantly increases the safety and speed of connecting bulk bags, as the operator can connect each bag loop and the bag spout without having to stand on a ladder or reach over equipment to secure the bag.

The machine's bagging rates are further increased by drastically reducing the time needed to load material into the bag. Whereas conventional fillers are typically mounted on load cells, allowing a PLC to open and close a valve or start and stop a conveyor to slowly fill the bag by weight, the new system employs dual gain-in-weight hoppers positioned above the bulk bag fillers. This allows pre-weighed material to descend into the bag at extremely high rates, and saves additional time by refilling the weigh hopper while the full bag is being removed and an empty bag being connected.

New sanitary bulk bag filling system from Flexicon features dual SWING-DOWN™ fillers with high capacity surge hoppers for rapid, safe and dust-free filling of bulk bags.

Once the inflator button is pressed and the collar secures the bag spout, filling operations are automatic. The fill head raises and returns to horizontal orientation; a dedicated blower fills the bag with air which removes creases in the bag, allowing the material to fill corners to create a stable bag; the surge hopper's roller gate valve opens; pre-weighed material fills the bag; the valve closes; the inlet seal deflates and the bag loop latches release, allowing a forklift to remove the filled, palletized bag.

Ports on each filler are vented to a dust collection system to prevent displaced air and dust from escaping into the plant environment. While a bag is being filled and then forklifted on one side, an operator can connect an empty bag on the opposite side, maximising output. Widened base frames allow filling of portable totes in addition to bulk bags.

The all-stainless-steel system is finished to sanitary standards and equipped with a corrosion-resistant, water-tight and dust-tight controls enclosure, allowing wash-down.

The company also manufactures bulk bag dischargers, bulk bag conditioners, drum fillers, drum/box/container tippers, bag dump stations, flexible screw conveyors, tubular cable conveyors, pneumatic conveying systems, weigh batching and blending systems, and engineered plant-wide bulk handling systems with automated controls.

With Flexicon's new TIP-TITE® Drum Tipper, hazardous bulk material is transferred from small and large drums into downstream processing equipment or storage vessels automatically and dust-free, maximising worker safety.

Flexicon TIP-TITE® Tipper discharges hazardous bulk materials from small and large drums automatically and dust-free, maximising worker safety.

The unit accommodates drums up to 200 ℓ measuring up to 880 mm in height, with an outside diameter up to 610 mm and weighing up to 325 kg. A discharge cone adapter allows dumping of smaller drums measuring 400 mm in height and 300 mm in diameter.

The tipper is mounted on an elevated base frame to accommodate an integral powered roller conveyor matched to the elevation of plant roller conveyors.

It features dual hydraulic cylinders that work in tandem to raise and seat the container rim against the discharge cone, and then tip the container to an angle of 45, 60 or 90 degrees with a motion-dampening feature. At full rotation, the discharge cone seals against the inlet of the receiving vessel, creating a dust-tight connection and allowing controlled, dust-free discharge through a pneumatically-actuated slide gate valve.

An optional pneumatically-actuated vibrator on the discharge cone promotes complete evacuation of non-free-flowing materials. Stainless steel material contact surfaces and galvanised carbon steel framework resist corrosive materials. ❑

Chain hoist with balancer function for intuitive load control

With the DCBS chain hoist, Demag presents a compact hoist which, with its smart control system, makes assembly and joining processes simpler and safer.

In its basic function, the DCBS is a variable-speed chain hoist based on the proven DCS range. The operator actuates the D-Grip Servo control handle and the load, with a maximum weight of 160 kg, is raised or lowered by an electric motor.

The integrated balancer function, adopted from the Demag D-BE electric balancer, enables loads to be guided and precisely positioned with ease, without the need to actuate the controller. The operator can simply move the load to the desired height with little force and can position it much more precisely with both hands. This makes the work easier –not only when exact positioning is required.

By actuating a switch or automatically, depending on the selected control mode, the DCBS unit switches between the 'grip control' and 'load control' operating modes for intuitive load control. The hoist is equipped with high-performance sensors to meet this requirement. The manual force exerted by the operator is detected in the grip control system by a pressure sensor and is used to control the lifting motion. This eliminates the need for the operator to press any buttons to control the hoist. An integrated load sensor detects the weight of a load and possible weight fluctuations and determines the desired direction of movement and speed from these values in load control mode. This allows the operator to move the load to the desired position using both hands.

In assembly mode, which is particularly suitable for horizontally joining components, any possible uncontrolled load movements are suppressed and converted into a gentle swaying motion, which enables components to be joined precisely. It avoids possible damage as a result of collisions between the parts and thus also increases handling rates during assembly.

All operating modes are linked to additional protection and safety functions, such as adjustable load or speed limits, and make working procedures even safer.

Combined with the Demag KBK light crane system, DCBS creates mobility for horizontal load transport. It can travel on KBK profile section rails, for example, on single-girder suspension cranes or in system suspension monorails and slewing jib cranes.

Demag DCBS chain hoist with balancer function for load handling with high precision. The ergonomic D-Grip Servo handle with integrated sensors and for control of the four load handling modes.

Besides its innovative direct load control, DCBS offers a number of design features that simplify its operation, improve safety and reduce service requirements

Taken together, all of these measures mean that the gearbox, slipping clutch and brake are maintenance-free for up to 10 years. ❑

One stop shop for custom-designed solutions services

BLT WORLD - which represents exclusive supply, service and distribution agreements of leading bulk handling equipment OEMs for Africa, discusses its product offering for materials handling.

SAMSON boom feeder receives material from trucks and transfers it to the stockpiling conveyor.

A leading supplier of materials handling equipment for some of Africa's OEMs, BLT WORLD has a large selection of conveyor systems, feeder equipment and screens from ScrapeTec Trading; SAMSON Materials Handling Limited and MDS International.

ScrapeTec's advanced AirScrape, DustScrape, TailScrape and SpeedScrape products are dust and spillage-control solutions, which are virtually maintenance-free, extend the service life of conveyor belts and reduce the cleaning requirements of the entire conveyor system. Apart from cost-efficient operation, the products also contribute to occupational safety and environmental protection and safety++ by minimising dust generation and contamination.

The contact-free AirScrape conveyor belt skirting system is a highly-effective side skirt that lies 2 mm above the conveyor belt, without contact, and creates negative pressure on the belt, due to its specially-designed blade structure.

Because the system hovers freely above the conveyor belt, skirt friction and belt damage are eliminated and the service life of every component of the conveyor is extended. It also minimises frictional wear on the belt, thus reducing power consumption.

BLT WORLD distributes the full range of SAMSON bulk handling equipment, which includes mobile material feeders. These are available on wheels, tracks or skids.

The equipment is known globally for increasing productivity by ensuring the efficient and flexible intake, storage and transfer of materials, with no compromise on performance, environmental standards, reliability or safety.

SAMSON material feeders are designed for high accuracy in feed control and operate efficiently in quarrying and mining environments.

The system – which is a portable, flexible and cost-efficient alternative to conventional underground apron feeders – is installed above ground, eliminating costly civil engineering works. It can be easily relocated for future plant development.

The material feeders are suitable for heavy-duty applications with continuous use (including impact loading from articulated dump trucks and large loading shovels) providing a buffer storage capacity, without the need for large ramps or underground pits. Since material is drawn from the tipping truck in a controlled stream, dust generation is significantly reduced, minimising environmental pollution.

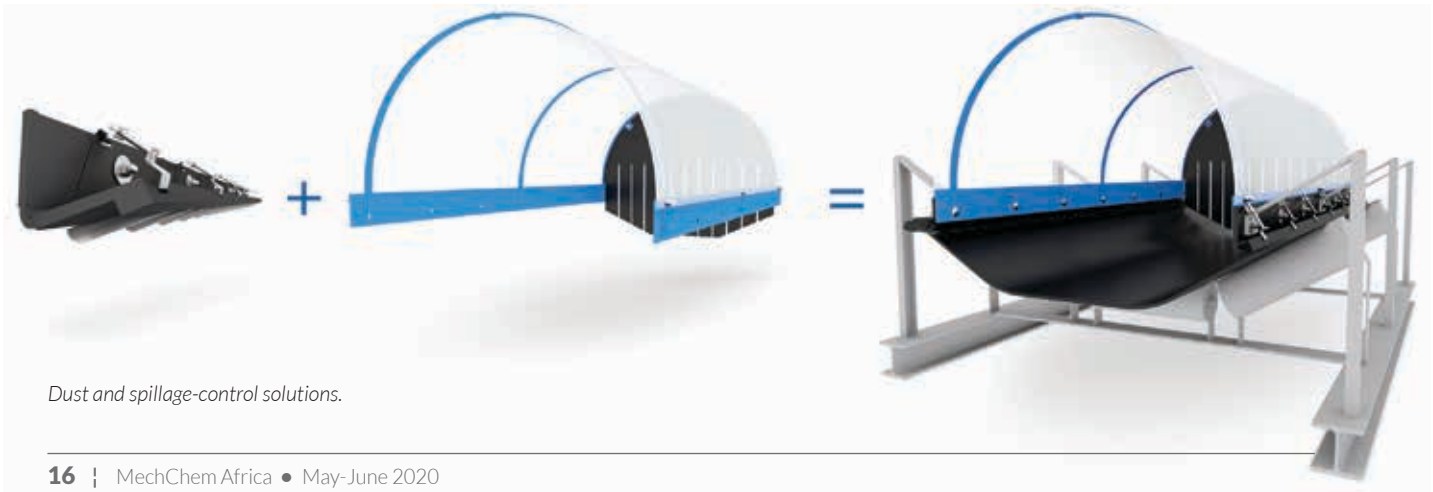
A wide belt design, with vertical hopper sides, enables fast truck discharge and the efficient conveying of any material, without risk of blockage. Steel apron bar technology provides the strength of an apron feeder with clean operation. Conveyor chains are always outside the material flow, which means chain wear is reduced and inspection and maintenance procedures are easy.

BLT WORLD's SAMSON mobile boom feeders offer high-performance, reliability and manoeuvrability in mobile stockpiling and rail car loading operations, without the need for permanent infrastructure. The Stormajor boom feeder combines the benefits of the Samson material feeder unit with a radial outloading boom, both of which are mounted to a common chassis as a fully integrated mobile stacker that is able to receive materials directly from tipping trucks, shovels and articulated dump trucks. The compact design means the boom feeder can be deployed and operational within minutes of being delivered to site.

Lastly, by using trommels to remove clay and wet, sticky material crusher and vibratory screen blockages are prevented. This efficiency contributes to increased production. BLT WORLD's MDS trommel screens and apron feeders have been designed especially for mineral processing and recycling applications. Flexible MDS systems are used to remove the small fractions from a waste stream, to make the remaining material easier for the operatives or processing equipment to handle.

The MDS M515 track trommel, with a 30 T hopper capacity, is capable of handling large rocks and efficiently separating difficult and sticky materials, like mud and clay.

The robust machine, which is designed to clean rocks in all weather conditions, has an advanced cleaning mechanism that keeps the drum apertures unblocked. The MDS M515 is supplied with fold-out stockpiling conveyors and is able to move around a mine and from one site to another. The M515 trommel is able to produce three products concurrently, at an output of over 400 tons per hour. ❑



Dust and spillage-control solutions.

Australasia agency adds to chute expert's global reach

Weba Chute Systems has concluded an agency agreement with Melbourne-based Mincore. The move marks another significant step in the South African OEM's strategy, which will increase its business in Australasia and extend its global reach.

Based in Germiston, chute specialist Weba Chute Systems boasts more than 4 500 transfer point systems operating successfully in countries across the world.

Of the 4 500 transfer point systems, 211 are in Australia. The company opened its Perth office in 2011, focusing mainly on the iron ore market in the western side of Australia.

The agreement will see Mincore cover central and eastern Australia, owing to the vast size of Australia and the extent of the country's mining industry. The company will also cover international markets such as Papua New Guinea and South-East Asia.

"With its wide range of customers and contacts in mining and engineering, Mincore is well placed to support us in promoting our bespoke transfer chute engineered solutions," says Weba Chute Systems sales director Farouk Abrahams. "The company has extensive experience of working with our chutes at mine level, so they have the necessary expertise relating to our products.

"Mincore is an established engineering company involved in the design, supply and construction services of material processing, material handling, and reclaiming for the mining and building material industries."

Abrahams says that Mincore has its own team of experienced materials handling design engineers, estimators and project managers, as well as a specialist Weba Chute Systems applications designer. This enhances the synergy between the two companies, placing the agency appointment on an ideal footing for a successful long-term partnership.

Weba Chute Systems has built its success on a scientific approach to the dynamics of bulk materials handling at transfer points. Through in-depth field studies almost three decades ago, the company analysed the negative and cost-incurring aspects of conventional chute design. Its solutions to mining and other industries since then have successfully eliminated the problems that were identified in this research. ❑

Weba Chute Systems offers a scientific approach to the dynamics of bulk handling at transfer points.

Experienced Weba Chute Systems applications engineers play an important role in the design of transfer points.

Approaches to managing corrosion under insulation

Corrosion Under Insulation (CUI) presents an ongoing, significant and costly challenge to processing industries, and still makes up a large percentage of global maintenance expenditures. President of EonCoat Merrick Alpert explains some approaches to better manage corrosion and its accompanying costs.

Manufacturing equipment such as tanks and pipes – constructed of metal and constantly exposed to heat, humidity, and various chemicals – are susceptible to corrosion. Corrosion that occurs on equipment covered in insulation is more problematic since it is not readily visible and its presence often goes undetected until major damage has occurred.

It is one of the major causes of many of the most serious problems facing process industries, including forced shutdowns, lost production, early repair and replacement, as well as safety and environmental consequences that can cost millions of dollars per incident. CUI can, therefore, lead to the need to shut down operations and in worst case scenarios, it can lead to process safety incidents.

Conditions in processing plants by their nature lead to corrosion. Once water penetrates insulation, CUI can progress via a number of different mechanisms depending on which chemicals are present. Electrolytes or salts, acidic or basic compounds, and leachable chlorides contribute to galvanic, acidic/alkaline, and chloride mediated CUI, respectively.

Water penetration can result from many causes including rain, flooding, wash downs, and sprinkler systems, as well as exposure to steam, humidity, or frequent condensation and evaporation of atmospheric moisture. Carbon and low-alloy steels maintained at higher temperatures in the presence of any moisture are at higher risk of corrosion.

When moisture penetrates and is trapped beneath insulation, the corrosion process can be accelerated, resulting in aggressive CUI, particularly for metals heated at or above 100°C, where intermittent boiling and flashing of water occur. CUI can appear as general corrosion, pitting, or stress corrosion cracking depending on the type of metal and the environmental conditions.

To prevent, or at least delay CUI, it is necessary to keep water and reactive chemicals from coming into contact with the metal surfaces of processing equipment. As a result, protective barrier coatings are most commonly used. Insulation can also be designed to direct water away from – rather than causing it to penetrate – the surface comprised of materials such as fibreglass, which do not retain water, and are often devoid of leachable chemicals that participate in the corrosion processes.

Ongoing maintenance coupled with an effective inspection strategy is also essential. Inspection methods range from removal of the insulation to view the surface of the equipment to evaluation of the surface through the insulation using x-ray analysis, neutron backscatter and infrared thermography, ultrasonic thickness measurement, pulse eddy current analysis, and other non-destructive techniques. The latter approaches can reduce the cost of inspections, but their limitations must be kept in mind.

As a preventative measure, polymer-based epoxy, polyurethane, and siloxane-based coatings are widely used for corrosion prevention. These types of coatings, however, only provide protection as long as they remain unblemished. Scratches, chips, and even tiny pinhole defects allow sufficient ingress of water and chemicals that can lead to corrosion. Once the coating is breached, it – and the insulation on top of it – can trap the water and any chemicals that promote corrosion, leading to CUI.

Recognising the limitations of organic, polymer-based protective coatings, EonCoat, based in North Carolina, USA, developed an inorganic alternative that addresses these shortcomings for steel processing

EonCoat conducts training and certification for all applicators, which is typically completed in one day.

Left: *Scratches, chips, and even tiny pinhole defects allow sufficient ingress of water and chemicals that can lead to corrosion.* ***Right:*** *Anti-corrosion coating for gas pipeline.*

equipment. "The spray-applied EonCoat is a chemically bonded phosphate ceramic (CBPC) that bonds through a chemical reaction with the substrate. The presence of a low level of surface oxidation provides a source of iron that promotes the reaction, which results in the passivation of the steel surface due to the formation of a magnesium iron phosphate alloy layer," says Merrick Alpert, president of EonCoat.

Chemicals, oxygen, and moisture cannot penetrate the layer, even if it is scratched or gouged. The chemical transformation of the steel surface into an alloy of stable oxides prevents corrosion from spreading beyond the damaged area. The alloy barrier layer is covered with a ceramic layer that further resists corrosion, water, fire, abrasion, impact, chemicals, and temperatures up to 205°C, Alpert notes. "CBPC coatings can control corrosion for decades, reducing the need for maintenance, downtime, and the potential for incidents. This may lead to cost savings and increased efficiency and safety of processing operations," he asserts.

The EonCoat formulation is 100% solids, water-based, non-toxic, non-flammable, odourless, and has zero volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). It can be applied at temperatures ranging from 5-50°C and humidities of 30-95% at a minimum thickness of 0.5 mm, with no upper limit. Acrylic, epoxy, and polysiloxane coatings have all been used as topcoats for the ceramic CBPC coating. EonCoat conducts training and certification for all applicators, which is typically completed in a day.

One company looking to leverage these benefits is China Petroleum & Chemical Corporation (Sinopec Corp.), one of the largest integrated energy and chemical companies in the world, with upstream, midstream, and downstream operations. Many of the company's facilities for oil and gas extraction, transport, and storage are located in China's Jianghan Plain in Hubei province, which has a sub-tropical monsoon climate. In that region, CUI and corrosion shorten equipment life and result in equipment and structures needing excessive maintenance. In this environment, traditional coatings have been ineffective, and stopping corrosion that is already underway is often the last resort.

Sinopec elected to explore the potential of the EonCoat CBPC coating. Its first project involved coating a 500 m^3 petroleum storage tank in an oil-extraction facility in the Jianghan Oilfield. The storage tank's original coatings were wrapped beneath a mineral wool insulating layer, but due to rain, condensation, and moisture invasion through the damaged insulating layer, the coatings had failed, allowing CUI to occur in a number of areas. The insulation was removed, the metal surface sandblasted, and the CBPC coating applied. "The application has effectively stopped the CUI issue and is expected to extend the storage tank's functional life for years to come," says Alpert.

The positive results of this project have led Sinopec to use EonCoat on a container-type water injection pumping station in another Jianghan Oilfield facility. The soil surrounding the pumping station has a high saline alkali content and the overall environment is very humid, and shutdown of the station for corrosion maintenance was typically required every three years. The pumping station generally had to be shut down for at least seven days to allow for surface preparation and application, and drying of the conventional three-coat barrier coating system.

For the CBPC coating, preparation will involve a NACE 3 / SSPC-SP 6 commercial blast compared to a NACE 2 / SSPC-SP 10 white metal blast cleaning for conventional anti-corrosion coatings. In addition, 'because surface oxidation', or 'flash rust' is desirable with EonCoat, there is no need to prepare small sections of the surface at a time. The surface preparation time is therefore reduced," adds Alpert. Furthermore, only a single coat is needed, and a coating applied at a thickness of 0.5 mm dries to the touch in 2–50 minutes. It can be returned to service in approximately one hour and is fully cured within about 24 hours depending on the temperature and humidity.

"Because return to service can be achieved in as little as one hour, users can potentially save hundreds of thousands of dollars per day in reduced processing facility downtime," Alpert observes. "Total coating application including surface preparation of the Sinopec pumping station took about two days, and the company was able to put the asset back into service immediately," Alpert concludes. ❑

Accumin™ lubricators optimise Warman® pump performance

The Accumin™ automatic lubrication system recently launched by Weir Minerals helps customers to get the most out of their critical assets by preventing bearing failures and reducing Total Ownership Costs.

Weir Minerals announced the global launch of its Accumin lubricators, following international demand for the grease lubrication, which has been ensuring optimal performance for equipment such as Warman® slurry pumps since 2014.

Across more than 100 sites, the Accumin lubrication system has proven itself as an efficient method of preventing expensive bearing assembly failures. It reduces maintenance downtime and promotes safety by decreasing the amount of manual interface required for optimal equipment performance.

"At Weir Minerals, we make the market-leading slurry pump for mining applications, but we can't always control what happens when it gets to site. Between dust, overflow and gland seal leaks, lubrication is a vital tool in the constant battle to keep machinery going," says Michael Roinich, Accumin specialist at Weir Minerals.

According to Roinich, fitting an Accumin lubrication system prevents over and under greasing, protects equipment from bearing failures and frees up man hours for more critical tasks.

"When we offer Weir Minerals equipment with an Accumin lubrication system installed, what we're really doing is giving that equipment its best shot at a long and productive working life," he says.

Made in Germany, Accumin canisters are produced in 125 cm^3 gas driven and 120 cm^3, 250 cm^3 and 500 cm^3 electro-mechanically driven configurations, and can be deployed up to 5 m away from the lubrication point, allowing easy and efficient access to the mount. The electro-mechanical driven lubricator dispenses a consistent dosage of lubricant, regardless of ambient temperature. The system delivers 6 bar of operating pressure and can easily be monitored via an LCD display, flashing LED alert system and a transparent grease cartridge.

"Designed to meet the arduous demands of the mining industry, Accumin single-point lubricators set the global standard for lubricating Warman pumps and other grease-lubricated, mission-critical mining equipment supplied by Weir Minerals. We're excited to share our market-leading, best-practice system with mines around the world who are embracing new technologies to simplify their operations," Roinich says.

The Accumin canisters can be deployed up to 5 m from the lubrication point for ease of access.

Accumin success on iron ore mine

A combination of increasing production and a change in maintenance procedures led to a pump bearing assembly fault at SIMEC Mining's Iron Duke concentrator in South Australia. When SIMEC's routine in-house analysis failed to detect this, Weir Minerals offered vibration analysis as part of their condition monitoring service, which operates in conjunction with the existing pump maintenance programme.

Weir Minerals identified the root cause as improper lubrication and external contamination ingress and were able to prevent a major failure of the Warman MCR 250 cyclone feed pump. Accumin 250 Lubricator units were installed to improve seal purging and prevent contamination, and a failed bearing assembly was rebuilt.

"Making the move to Accumin lubricators helped the iron ore mine save almost AU$120 000 each year in downtime reduction, pump rebuilds and bearing assembly replacements," concludes Roinich.

Accumin lubricators are available worldwide on new pumps, through Weir Minerals' aftermarket spare parts supply channels and via its service centre network. ❑

Hygienic enclosures for vacuum pumps

In the food industry, vacuum pumps are often placed next to the processing and packaging lines and therefore not implemented in the equipment. On one hand this leads to a higher vacuum performance because losses in pumping speed over long pipelines are avoided. A direct positive consequence of this is shorter process cycles and a better product quality. On the other hand, unprotected pumps are directly exposed to aggressive cleaning media during the rinsing processes. Over time, this leads to corroded vacuum pumps, shorter life cycles, higher costs and food contamination.

To ensure that vacuum pumps are effectively protected during regular washdowns, Leybold has developed a new protection concept – a series of hygienic enclosures. Encased by these stainless-steel enclosures, the vacuum pumps can be positioned near machines and systems without any problems.

"With the protected Leybold vacuum pumps, we can create better and more robust solutions for demanding food applications," explains product manager, Niels Gorrebeeck. "This also applies to applications such as stuffers, tumblers and packaging machines, where the machines and systems are cleaned and disinfected frequently and intensively."

Gorrebeeck explains that the stainless-steel enclosures are tailor made for each vacuum pump. As a result, each enclosed pump can run constantly on every working pressure. The only limitation is the highest ambient temperature for the enclosure. The normal working temperature in F&P environments is around 10°C, where the company has qualified most enclosures up to 25 °C. These properties make the hygienic enclosures a cost-effective, sustainable solution. "In the end, hygienic enclosures make investments in expensive piping obsolete, and offer a better pumping speed performance," argues Gorrebeeck.

With Leybold's holistic solution approaches, food applications can be operated more hygienically, ergonomically and flexibly, he concludes. ❑

Pumping expert keeps mines afloat during lockdown

As an essential service provider, Integrated Pump Rental is assisting coal mines and power producers during the national lockdown. The pump rental company explains how well it is positioned to assist mines as they start gearing up their operations.

The mobile trailer mounted Sykes CP pump unit is easy to get to site and get working.

Having provided services to the coal and power sector during the initial phases of the COVID-19 lockdown, Integrated Pump Rental remains a critical service provider as mines start gearing up their operations.

"As process plants ramp up their production over the coming weeks, many are likely to experience challenges related to having had their operations temporarily shut down," says Lee Vine, managing director of Gauteng-based Integrated Pump Rental.

"These problems vary from pipeline blockages and pump failures, to lack of storage capacity in process water ponds. This is exactly where we can step in with solutions to see them through."

Experts in dewatering, water transfer and dredging, Integrated Pump Rental has been active throughout the lockdown period to date, responding to urgent requests from coal mines and power producers.

"As a 365-day-a-year operation, we have always worked around the clock to assist customers in need," says Vine. "For the lockdown, we are geared up with all the necessary hygiene infrastructure, as well as the documentation and permissions to facilitate a quick response to emergencies.

"Keeping our teams safe during this global pandemic is top-of-mind for us, as is the safety of all personnel on the sites in which we operate. We will continue to adhere to these measures stringently," he says.

With equipment ranging from powerful high-head, high-flow mobile dewatering pumps to submersible pumps and specialised dredging units, the Integrated Pump Rental fleet serves a range of industry demands. Experienced staff ensure that the units are applied effectively in every application.

"Our SlurrySucker® slurry removal solution ensures mines and industrial water contaminated sites do not negatively affect the environment and surrounding areas.

"Not only does the Integrated Pump Rentals' SlurrySucker dredging system effectively clean process water ponds, it has become recognised as an ideal solution for cleaning water capture areas where silt or slime is an issue or where water retention and water holding capacity is being threatened. Some of these areas are environmentally sensitive and must be protected from causing any pollution.

"Through our SlurrySucker product range, we are able to offer a complete solution to effectively remove slurry from any water-based environment and in so doing now offer one of the most cost-effective solutions for any dam cleaning project," adds Vine.

The benefits of the SlurrySucker extend well beyond improving mines' environmental footprints. They enable increased water storage, the recovery of minerals and improved processing water quality.

They further make it significantly easier to extend the life of water-dedicated assets by protecting dam plastic liners. Clients are consequently able to incorporate slurry removal projects into their planning in order to extract greater value from all non-mining areas.

"Bodies of water, such as ponds, lagoons, dams and canals should be considered valuable plant assets and must be maintained to maximise their operational efficiency and contribution to optimised operational performance. The SlurrySucker delivers without fail in this area," Vine confirms.

The SlurrySucker is sized to meet the clients' slurry removal requirements in terms of particle size, aggregation, distribution, cohesiveness, flow characteristics, sedimentation rates and specific gravity. Typical suction water agitation dredging usually achieves 20% - 30% solids for SGs up to 3.0.

Vine highlights two product options – the Maxi SlurrySucker that is capable of moving 250 m^3 an hour at 20% - 30% by volume, which is equivalent to approximately 70 dry tons per hour. The Mini SlurrySucker, which operates at 100 m^3 an hour, at 20% - 30% by volume for roughly 30 dry tons every hour.

Whether short-term pond clean-ups or ongoing pond management projects, the SlurrySucker is designed for difficult site conditions for many applications.

A range of top-end quality Sykes pumps offer efficient and cost-effective dewatering.

The SlurrySucker has an established reputation for cost effective dam cleaning.

"During the lockdown, we have already had to dewater a flooding coal mine in KwaZulu-Natal and respond to an urgent request in the petro-chemical sector," Vine says. "For vital dewatering applications, our range of diesel pumps can run unattended for 24 hours at a time while our submersible pumps can run indefinitely. We also advise customers on the best and most cost-effective solutions," he concludes. ❑

Finding wastewater solutions for Africa

Engineers and representatives from KSB Group companies throughout sub-Saharan Africa have committed themselves to finding workable solutions for Southern Africa's growing wastewater crisis.

As governments and municipalities across Africa seek ways of dealing with growing wastewater requirements, it has become increasingly evident that a 'one-size-fits-all' approach does not work and that differing conditions, such as sand content, water quality and existing infrastructure, play a large role in the specification of future pumping infrastructure requirements.

This has prompted the global pump and valve manufacturer to play a more active role and lend its technical expertise – through its extensive network of regional companies, branches and dealers – to assist wastewater entities.

Preparations to support an intensive new wastewater drive got underway at the regional office of KSB Pumps and Valves in Johannesburg, where Ben Harrison, global expert and regional application manager: MEAI KSB Global Corporate Water Department (Germany), led a two-day workshop aimed at sharing country specific information and devising ways of working with authorities to provide wastewater solutions.

"As one of the largest pump companies in the world and a major role-player in Africa, we are listening to the needs of the market and taking information from our representatives in each region to our technical department to find pumping solutions for each district. Conditions vary, therefore we have invited authorities to work with us to find specific solutions that will work for them," says Harrison.

He explains that all KSB sales engineers are able to discuss requirements on equal terms with engineering teams and that they can call upon local and international expertise to find the right pumping solutions for the right job.

In most countries and districts in Africa, KSB is well entrenched as a main supplier of potable water and other fluid transfer solutions to governments and utilities.

Now that the company has assembled its internal staff and put in simplified structures to support wastewater pumps in each region, it can be expected that it will hit the ground running and make significant inroads in a market that currently does not enjoy the attention of other large pump manufacturers. In South Africa, KSB also has the advantage of being a Level 1 BBBEE contributor.

"KSB has the support and expertise to support plans to deal with future wastewater requirements. We understand that expectations don't differ by country and we assure customers that the same knowledge that is required for engineers in KSB, is the same requirement in every country.

That means that customers can expect the same outcome and the same service and support that they would receive anywhere else in the world. It is also advantageous that sewage pumps are part of the South African production portfolio for quick access to the regional market.

"This is our way of reaching out to the wastewater industry in Africa and we invite each and every entity involved in the process to interact with us and to make use of our services," Harrison concludes. ❑

KSB staff from across Africa will be working towards finding waste water solutions for the continent.

Correct pumping solutions assist in efficiency

Verder Pumps South Africa MD Darryl Macdougall explains why paper and pulp manufacturers need to look to a trusted and reputable brand that can offer a range of pumping solutions that are long-lasting, cost-effective and energy efficient.

"Manufacturing paper is a resource-intensive process, even if it is 100% recycled material. Shredding wood, paper and textiles to the right size, creating the pulp, and then pressing it into paper is a process that requires the right equipment, including pumps to move the slurry," explains Macdougall.

He adds that paper and wood pulp, as well as the chemicals used in the bleaching process, can be abrasive and corrosive to pumps and pumping systems. Therefore, a poorly designed pump system may lead to losses in production, owing to the premature wear or failure of components. This would not be isolated to the pump itself, but can impact on instrumentation, piping, valves and ancillary equipment.

Macdougall points out that, with this, there is also the risk of work stoppages or breakdowns in addition to routine planned maintenance. "Any of these possible scenarios is guaranteed to hamper operational efficiencies and production outputs – not to mention potentially increasing labour costs and inventory of spare parts – leading to operational expenses being driven up."

However, he reassures that having the correct advanced and integrated pumping solution can support manufacturers' operational efficiency objectives.

"Our series of Verderflex pumps is ideal for harsh environments and pumping abrasive liquids. This makes them fit-for-purpose for paper and board making applications; pulp pre-treatment, pulping, bleaching and post pulp washing; thickening and dewatering, and the final stage of paper making," Macdougall points out.

"In addition, our VerderPure diaphragm pumps are machined double-diaphragm pumps constructed of solid polyethylene or polytetrafluoroethylene, making them impervious to corrosion and highly resistant to wear. These solutions are suitable for pumping pigments, adding coatings and polyurethane laminates, and abrasive slurries in the process."

From an operational efficiency and cost management point of view, as well as promoting more sustainable business practices, Macdougall mentions that there is a growing interest in and focus on reducing reliance on water from paper manufacturers.

"For example, water has always been fundamental to the manufacturing process. However, often the demands for process water result in additional investment in water-treatment and reprocessing facilities. This further increases the initial cost of any project and impacts on the natural environment," he says.

Macdougall highlights that adopting novel techniques, and focusing on efficiency and the associated operational costs, will yield the optimum return for manufacturers. ❑

Rockwell Automation supplies modern control solutions for Intermerc Ghana

Over the past five years, Rockwell Automation has been working with Intermerc Ghana to supply medium voltage motor control and automation technologies to some of its recent pump upgrade and rehabilitation projects for Ghana Water Company.

By upgrading and adopting modern pump and control systems, Intermerc has been able to improve the performance, efficiency and reliability of water treatment works across the country. In so doing, it has helped Ghana Water Company increase access to water for many citizens of the country.

At the Daboase, Inchaban and Kpong water treatment works, new high lift pumps have been installed and are being controlled with IOT-ready Rockwell Automation Bulletin 1503E SMC Flex medium voltage soft starters.

At the Daboase High Lift Works and Apparatus, Intermerc identified the possibility to expand pump capacity by 15% without any civil or other mechanical requirements. This would allow Ghana Water Company to increase the penetration of its bulk water supply to the greater Takoradi region. The solution required two new higher rated high lift pumps, paired with the Rockwell Automation soft starter.

The extra volume of water this added to the bulk water supply of the region necessitated a pump upgrade at Inchaban pumping facility. Intermerc specified, supplied and installed three new high lift pumps to achieve the additional volume requirements.

At Kpong, Intermerc was tasked with rehabilitating the feeder pumps that elevate the treated water from the Volta River to feed the high lift pump that transports the treated water to Tema and other parts of Accra.

"The Rockwell Automation Bulletin 1503E SMC Flex was the optimum soft starter technology for these pump applications," explains Michael Klugey, technical manager, Intermerc Ghana. "Together with its intelligent autotransformer starter capabilities, it also delivers significant energy savings with an efficient motor control framework, and helps optimise pump performance for an extended product life."

The 1503E SMC Flex provides microprocessor-controlled starting for standard three-phase squirrel-cage induction motors. The feature-rich technology delivers electronic motor overload protection and built-in DPI communications and includes four programmable auxiliary contacts and self-powered current loop gate driver boards.

The motor control panels were assembled by Rockwell Automation Sub-Saharan Africa with a local panel manufacturer.

IOT-ready control framework

Employing the advanced analytics and diagnostics capabilities that come standard with new-generation Rockwell Automation equipment, Intermerc and Rockwell Automation are currently piloting a remote monitoring and live data system that will provide Ghana Water Company with a full real-time representation of the Daboase, Nchabang and Kpong pump works.

This will enable operators to respond faster to plant and equipment events, with an in-depth analytical understanding of plant performance. ❑

Aurecon ensures office development an iconic

Engineering, design, and advisory company Aurecon supplied mechanical and environmentally sustainable design (ESD) services for the iconic 144 Oxford Road office development in Rosebank, Johannesburg. This played a key role in the project aiming for a 5-Star Green Star Design Certification from the Green Building Council of South Africa (GBCSA).

Developer Growthpoint Properties appointed Aurecon in 2017 for the 35 0000 m² premium-grade office development, which was completed in 2019 and aims to capitalise on the demand for office space in the popular precinct.

Aurecon was part of the project team at an early stage while various iterations were reviewed in order to establish the most feasible scheme. Close collaboration with Paragon Group and the rest of the project team was necessary to ensure proper coordination of all building services. Aurecon is currently in the process of rebranding as Zutari, after officially announcing the separation of the African business from the Aurecon Group, effective from 1 January 2020.

Aurecon Technical Director, Brandon Huddle.

The nine-storey development features two elongated office towers interlinked by a central atrium along the north-south axis. Spanning the entire nine floors, the atrium offers a visual link to the outside. The west façades are shaped towards a curved glass pinnacle that cantilevers outwards towards the road.

The main façade consists of double-glazed unitised façades, incorporating a dark grey glass. The outermost façade of the northern building features a secondary offset glazed 'skin' with raking sides. "The high-performance glazing used on the project had to be factored into the cooling load," says Aurecon technical director, Brandon Huddle. "The glazing has been coated and baked with a variety of chemicals to reflect heat. This means that, while it allows natural light to enter, heat wavelengths are reflected back out of the building."

One of the key sustainability features of the project is the air-conditioning system based on four 800 kW CIAT chillers from Sky Shot Climate Solutions. The total cooling provided for the project is 3.2 MW, serving 17 air-handling units (AHUs) that cater for the different thermal zones in the building. Each AHU handles roughly 12 m3 to 18 m3 of air, which makes for a highly cost-effective design. The Variable Air Volume (VAV) diffusers used were provided by Rickard Air Diffusion. The diffuser groups each cover a 50 m² to 100 m² zone, and can each be controlled individually.

Each AHU is fitted with an intelligent control valve with a built-in energy meter, which means that the precise R/kWh can be calculated. The CIAT chillers have variable-speed condenser fans for increased energy-efficiency, supplying water at 6°C, which is returned from the building at 12°C.

A major contributor to the optimised energy performance of the building is the fact that the AHUs have dampers that are able to shut-off the return-air flow if external ambient conditions are below those of the return-air temperature, which typically provides maximum benefit between 12°C to 18°C. This allows for natural cooling of the building, taking advantage of the ideal Johannesburg climate.

"The building is very well sealed, as normally the unitised curtain wall façades tend to leak a lot. The air under economy cycle mode needs to be released from the building

TLT ACTOM launches complete ventilation solutions

TLT ACTOM aims to offer South Africa's mining and power sector more than just innovative ventilation fans – their customised systems ensure that working conditions are safe and energy efficiency maximized as part of a holistic Total Ventilation Solution that aims to reduce total cost of ownership.

Operations Director, Craig Johnston believes that TLT ACTOM's approach is ideal for addressing the concerns of the Southern African market. "We have come to realise that in Southern Africa power is becoming a far higher input cost in our industries and processes than it was in the past," says Johnston.

"TLT ACTOM prides itself on applying innovative, lateral thinking to solutions that save energy by offering the best efficiency selections for the applications. We can supply products that are not only more efficient in their performance but are also tailored to deliver the required air at the required time. For example, a fan that is designed to have different degrees of control in order meet the specific levels of ventilation required for increased ambient temperature or activity or when measured pollutants move beyond a pre-set tolerance."

TLT ACTOM's Total Ventilation Solution approach aims to provide complete solutions to the challenges of subterranean mines, thermal power plants and numerous industrial process applications including cement production and waste incineration. According to Johnston, the main focus will be on make clients' operations more efficient in terms of both performance and energy consumption, thereby having a significant impact on total cost of ownership.

"Capital cost is one aspect that clients are most heavily focused on but TLT ACTOM strives for excellence in power efficiency, maintainability and life expectancy – all factors that can easily outweigh the initial purchase price. To do this we rely on superior technology derived from our parent company TLT-Turbo," Johnston explains. "The most innovative suppliers can help their clients to look beyond the initial capital cost and to consider the short, medium and long term running costs which include absorbed power and maintenance."

Johnston elaborates with an example of how their innovation ensures that clients see a return on investment. "As part of a recent study, TLT ACTOM proposed to replace two existing mine ventilation fans with a single axial fan. Because of its higher efficiency, it will use the same amount of electricity that one of the existing fans currently does, resulting in a saving of approximately 500 kW. The calculated annual energy saving is R 3.6 million making the

'green' initiative

to allow supply air to enter. Relief air dampers on the roof in the atrium return-air path open and close automatically, depending on the economy cycle damper positions," explains Huddle.

As long as the external temperature is lower than the temperature of the return-flow air, it means that the air-con system operates in economy mode. The entire HVAC system, in turn, is integrated with the Building Management System (BMS), which schedules the air-con system to operate from 05:00 to 19:00 as determined by the landlord.

The roof-level AHUs are covered to protect the ducting from solar-heat gain, which saves costs such as additional insulation and cladding. It also saves costs in that components such as the AHUs, control panels, and Variable Speed Drives (VSDs) do not have to be weather-proofed.

"If you add up all the extra costs and the operational benefit, it is well worth the investment. An additional benefit is that it facilitates any maintenance needed to be carried out by technicians," Huddle points out.

A particular innovation implemented by Aurecon on this project was to detect refrigerant leaks from the air-cooled chillers. This limits the environmental damage caused by refrigerants with ozone-depletion or global-warming potential.

Another 'first' for the project was using Siemens intelligent valves, which can be accessed by means of an app in order to determine energy consumption, flow rate, and valve positioning. In addition, there is BMS-addressable energy-efficient lighting throughout, water-saving sanitary fittings, a rainwater harvesting system, extensive glazing to maximise external views and natural lighting, and water-efficient landscaping.

Above: *The total cooling load is 3.2 MW, serving 17 AHUs catering for different thermal zones.*

Right: *The nine-storey 144 Oxford Road office development for Growthpoint Properties.*

A facilities manager was actively involved during the design phase to ensure that the operational intent of the sustainability initiatives was implemented effectively following the commissioning of the building services.

Described as an iconic development, the Gautrain servitude cuts through the site, which restricted the allowable construction methodology to be used. Further to this, Oxford Road sits within the site boundary. All these factors contributed to a long and intensive design process that took into account site-specific parameters, together with stakeholders' particular needs and requirements.

Aurecon worked closely with Growthpoint Properties, Paragon Group as architect, and the professional team through the various iterations of the building's design to ensure that the mechanical services and the sustainability objectives were aligned seamlessly with the ultimate design. ❑

payback extremely attractive."

The current installed base of process and ventilation fans is aging, and in tough times this equipment has to be carefully maintained to achieve the expected life of product. To do this TLT ACTOM provides a dedicated skilled team of fan specialists to monitor and maintain installed systems.

"Where replacements are required, we offer the value-added service of critically analysing the existing plant and using an intellectual approach to offer improvements such as in efficiency, size correction or wear durability. Wherever possible this can be achieved without replacing the entire fan but in retrofitting the rotating element with minor modifications thus minimising the capital spend for the customer and ensuring an acceptable return on investment," says Johnston.

Johnston believes that TLT ACTOM is able to address the unique challenges of the African market through a combination of the design of their products, their Total Ventilation Solutions approach and support from TLT-Turbo. "With TLT Turbo as our 'technology parent' TLT ACTOM has the ability to offer fans for the most arduous of conditions. From cement plants where wear and high temperature is a factor or mining fans where water droplet erosion can cause damage to fan solutions where erosive and corrosive conditions exist, TLT ACTOM has a solution."

"We pride ourselves in working with our clients to fully explore options and to share the latest developments. We hope that by applying the Total Ventilation Solutions approach, our current and potential clients will come to realise that TLT ACTOM sells more than just fans," Johnston concludes. ❑

TLT ACTOM's Total Ventilation Solution approach aims to provide complete solutions to the challenges of subterranean mines, thermal power plants and numerous industrial process applications.

Towards better water management

MechChem Africa talks to Chetan Mistry, strategy and marketing manager at Xylem Water Solutions SA, about South Africa's urgent need for better water management to mitigate against climate change and the fast evolving set of solutions becoming available to support more efficient and more local wastewater handling and recycling.

According to global rankings, South Africa is ranked 39th in terms of lowest rainfall and, in terms of water stress, we sit near the middle at 65th out of 180 countries. "But don't be fooled: water is an enormous challenge for South Africa. Global rankings don't reflect the nuances on the ground, such as average rainfall varies dramatically between different local regions. Examples of droughts causing havoc in the country are scattered all across South Africa's history," says Chetan Mistry, strategy and marketing manager at Xylem Water Solutions SA.

Mistry cites the recent drought in the Western Cape, which "nearly brought an international city to its knees", along with the current plight of the Northern and Eastern Cape regions, where "incredible droughts, are causing trees to fall over".

Even in Johannesburg, "the local catchment area doesn't produce enough water to quench Egoli's spiralling urban population and we are consuming 530-million litres more water than the area delivers.

"These are not alarmist notions. They are facts, and the situation is likely to become much more aggravated owing to climate change. While South Africa receives enough rain on average, we do a poor job of capturing and managing water resources and such neglect will have severe social and political consequences," Mistry says.

"We at Xylem come into play when it comes to abstracting water; transporting it; treating, measuring and controlling its distribution; and then collecting the wastewater and developing different ways of recycling it to make it suitable for consumption again," he tells *MechChem Africa*.

"The water management conversation is around waste and the need to massively reduce it, both to conserve the water itself and to better recover the revenue lost through leakage," he suggests, adding that in South Africa 25% of our drinking water is estimated to be lost to leaks, while globally, a "staggering" 46-billion litres of drinking water is lost every day.

"As a scarce resource, we should be fighting to preserving every drop and to plug every leak in every part of the transportation system," he urges, adding that efficient modern leak detection is an essential weapon in this battle.

"South Africa has taken a centralised approach with respect to water distribution, where water is collected, stored, treated in designated plants and then transported to urban and rural end-users. A high percentage is lost before arriving at these users and, from a billing perspective, this can represent a substantial percentage of lost income for the water provider, which raises the overall costs of water provision.

"Many kilometres of piping are required to interlink these systems and damaged and eroded pipes are everywhere. It also takes a long time to detect and repair leaks. Trenches have to be dug to find and repair pipe leaks, roads are blocked causing traffic disruption and substantial amounts of time and energy are wasted, over and above the water loss, itself. In addition, many leaks go undetected for long periods of time," he says.

Based on global experience of finding water leaks, Xylem has developed a SmartBall® technology, which massively simplifies the task. "SmartBall is a free swimming, tennis ball-sized sensing device designed to be carried with the water in a pipeline. The ball contains wireless-connected acoustic sensors, accelerometers and gyroscopes and a GPS tracker that enables leaks and other pipe condition issues to be identified and accurately located.

"SmartBall tracks the movement of water within the pipe, identifies blockages and leaks and sends the data back to Xylem for analysis. It can place a problem to within 1.8 m and it can inspect up to 40 km of piping a day," Mistry tells *MechChem Africa*.

"No cutting into pipework is required. The ball is simply put onto the pipework at one end and recovered when it exits the catchment at the other. It offers more economical and less disruptive and intrusive ways of finding leaks – and the revenue loss of the leak will usually far outweigh the investment cost of applying the technology," he says.

According to Mistry, another important area for raising water management standards in South Africa is metering. "If we are to value water more highly and use it more sparingly, we have to also be obsessed with metering water use. For this, accurate and modern water meters are needed to enable us to account for any losses and to help us to identify ways of reducing consumption.

"Pre-paid meters, for example, are known to change usage behaviour. Every running tap needs to be metered and paid for, but it is only

Xylem solutions for mining are geared for harsh conditions, offering highly flexible pumping, treatment and water management solutions that enable water to be repurposed within the mine's operations.

when people know and understand this that their usage behaviour will begin to change," he notes, adding that making people aware of water losses is an essential starting point for water conservation.

He cites the numerous attitudinal changes that have been adopted by Capetonians following their crisis, such as buckets under showers for use in toilets and harvesting grey water for use in gardens. "It often takes a crisis to develop attitudinal changes with lasting effects," says Mistry.

With respect to grey water collection, he says that Xylem's Cape Town office is now also collecting storm and rain water from its roof for recycling. "We have installed a filtration and an ozone-based water purification system to create potable water onsite for consumption by our staff on a daily basis," he continues.

"We believe water systems are going to evolve from being centralised to having many more decentralised elements. Systems such as the one installed at our offices demonstrate how water can be accessed and processed onsite for consumption onsite. This can be true of a house, a factory or a mine and it enables a significant proportion of the local water required to be made available for direct use at its point of collection," he informs *MechChem Africa*.

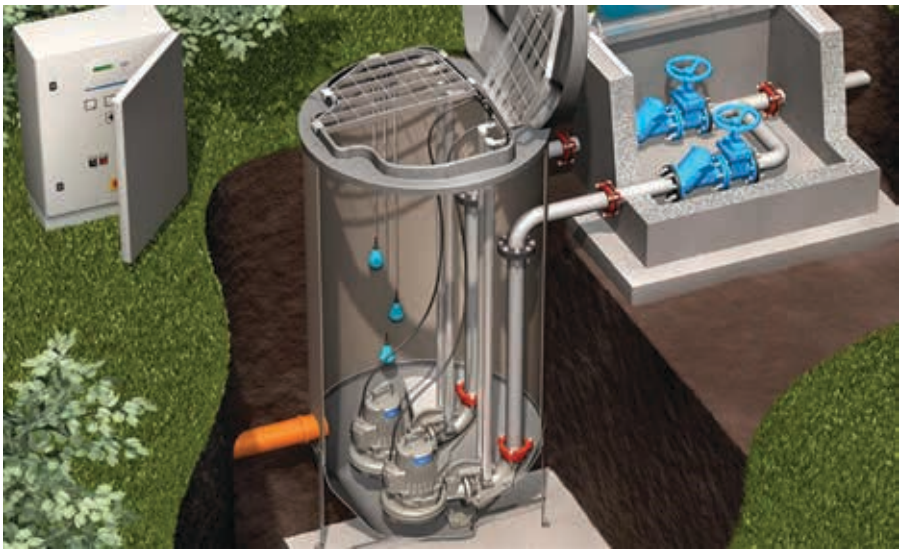
A particular advantage is that wastewater contamination tends be different depending on where and how it is generated. By treating at the generation point, the process can be tailored to specifically suit the wastewater involved, making the treatment process more efficient than if transporting and combining different wastewaters together for centralised and more multi-faceted processing.

In addition, if the water is to be reused at the point of generation, then the water quality level can be tailored for its intended use. Factory water may not need to be processed to potable quality, for example. Instead of having centralised wastewater treatment plants that have to cater for every conceivable contaminant, each wastewater type can have a customised and simpler solution to make it suitable for its intended reuse.

"This is an investment opportunity that circumvents the need for sending rainwater back for treatment at the centralised plants, while reducing local water bills. It's the same basic principle as having solar panels on the roof for generating electricity at the point of need," Mistry argues.

The same principle applies in industrial spaces, but the scale can be far more cost-effective and/or less punitive. Onsite treatment of industrial wastewater is often a prerequisite to avoid polluting the river systems, but if taken a step further, treatment can be tailored to enable the water to be locally recycled for the industrial process being employed, reducing the depletion of scarce local water sources and saving on municipal bills.

Based on global experience of finding water leaks, Xylem-owned Pure Technogies has developed a SmartBall® technology, which massively simplifies the task.



Globally, Xylem offers a wide range of pre-engineered packaged pump stations including pumps, tank, piping and valve systems, along with all the required installation accessories and monitoring and control equipment.

"The benefit of Xylem's approach is that we operate across the water cycle, with comprehensive solutions from abstracting and treatment to transporting, metering of consumption, wastewater treatment, and water recycling to whatever quality is required.

"In mining, for example, our solutions are geared for the harsh conditions. We offer highly flexible pumping, treatment and water management solutions that enable the water to be repurposed within the mine's operations. We strive to find ways to increase productivity, reduce costs and turn water management from an expense into a strategic advantage," he says.

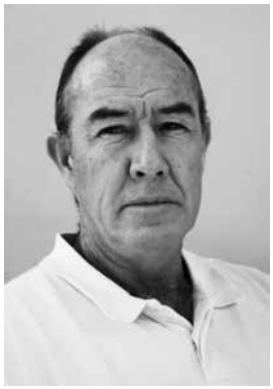
He adds that this is equally true for agriculture. "It is important to avoid overwatering and this is now economically achievable by installing efficient modern flow and pressure controlled irrigation systems. These smart pumping solutions can measure exactly how much water is being applied and can automatically shut off when the required daily amount of irrigation has been delivered," Mistry says.

Water audits are another key service on offer in order to better ascertain how best to conserve and reuse scarce resources. "Regular water balance audits are vitally important to ensure optimum water usage, equipment efficiencies, maintenance planning and to minimise waste and costs.

"At Xylem, through our solutions and global initiatives such as our Water Mark system, our CSR programme, we are striving to raise awareness about the importance of water among every Xylem employee and the communities in which they live, helping to implement water efficient solutions, cleaning rivers and helping communities with access to clean water.

"Through partners such as Engineers Without Borders, we are striving to make water accessible to every human being, while implementing management solutions that preserve every drop we can," Mistry concludes. ❑

ECA water treatment, the Carbotect test



MechChem Africa talks to Robin Kirkpatrick, managing director of Carbotect and the inventor of a simple and affordable testing system for biologically contaminated water for the food and beverage and agricultural industries, about novel Clean in Place (CIP) approaches and the increasingly important role his Carbotect water test can play as a more proactive strategy for reducing contamination risks.

Robin Kirkpatrick trained as veterinary surgeon and spent the first few years of his career in clinical practice in South Africa and then overseas. When he returned to South Africa he joined Shell Chemicals to develop and market new products for the control of parasites on farm animals. "At that time, I spent several years travelling through sub Saharan Africa doing development and commercial work," he tells *MechChem Africa*.

In 1999, having had "a skin full" of the corporate world, he joined a small team called Radical Waters, which kicked off an innovative career trajectory in the water industry, more specifically, in the development of hygiene solutions and associated water contamination treatment and testing techniques.

Based on an uncommercialised process developed in Russia, Kirkpatrick and his colleagues from Radical Waters began to develop a production scale CIP process called Electrochemically Activated Water Treatment (ECA). "ECA involves electrolysing a very dilute brine solution, which has proved effective for disinfecting water and an ideal alternative for chemical-based CIP treatment options," he explains. The process is directly microbicidal, but it is also able to control and, in most cases, destroy biofilm.

Describing how ECA works, Kirkpatrick says that the dilute brine solution is electrolysed in an electrolysis cell with a separating membrane, and produces two streams of oppositely charged and activated solutions, which ultimately return to their benign water state. "The electric current passing though the cell produces positively charged water ions that are superbly effective at neutralising bacteria. This process is an ideal alternative to the conventional chemical treatment processes, because it uses both electricity and a dilute concentration of activated chlorine compounds as opposed to having to use chemical solutions and high temperatures to destroy bacteria and other dangerous microorganisms.

Delivered as a 'laboratory in a box', the Carbotect test can return a CIP water rinse quality test result within five minutes and is designed to be used by plant operators without the need for a laboratory or the presence of a laboratory technician.

"The positive water ions scavenge electrons from viable bacteria, which disrupts their stability or homeostasis, with the net result that bacteria, viruses, algae, yeasts and fungi are all rendered non-viable due to the electrical imbalance the process creates," says Kirkpatrick.

"A REDOX potential in the water of about 850 to 900 mV is sufficient to effectively scavenge all of the surplus electrons in the water system and eliminate microbes, both waterborne and adherent ones in the form of biofilm," he adds.

He explains that electrostatic charge is one of the mechanisms that enables biofilm to successfully adhere to the inner surfaces of process piping and vessels, particularly those used in the brewing, dairy and bottling industries; in food processing plants; and in animal feed-water systems. The biofilm has a predominantly negative electrostatic charge, which is lost when its electrons are scavenged by the positively charged ions in the water," he informs *MechChem Africa*.

"After several years of development, I completed a PhD in ECA technology and, today, the process has developed into a very effective substitute for chemical CIP processes. Instead of having to use the likes of caustic soda solutions at 80 °C, the ECA process enables an ambient temperature regime to be used with net energy savings of around 70% and a reduction of 98% in the consumption of cleaning chemicals. In addition, system cleaning time is halved and water use is substantially reduced," he notes.

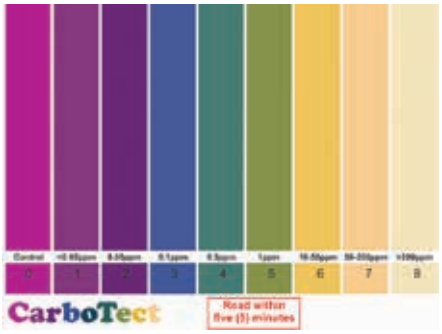
The need for an alternative water quality test

"In order to assess the efficiency of the ECA treatment process and prove it was an effective replacement for existing CIP solutions, we had to rely on conventional microbial laboratory testing as per the standard protocol. For these test results, we had to wait for between three and five days before we could ascertain if we had achieved the final rinse water quality required for optimised CIP effectiveness.

"This inherent time lag led me to seek out a quicker way of determining whether all the residual organic product such as microbes, biofilm and residual organic soils had been purged. The original idea was to create a quick and easy to use 'stop/go' system that enabled operators to quickly ascertain when the CIP process had been successfully completed," recalls Kirkpatrick.

Biofilm that tends to accumulate in entrapment areas of processing equipment such pumps, valves and dead ends emerged as a particularly interesting area. "After effective cleaning programmes, I continued to pick up false positives which, on investigation, turned out to be caused by biofilm downstream of the bulk water treatment plant in the fresh water coming into the plant.

and reducing contamination risks



The simple colour-based Carbotect test enables CIP effectiveness to be qualified based on a specific colour change that occurs, and semi-quantified against a standard chart based on the degree of colour change that occurs in a given time, typically five minutes.

Compared to the ATP swab test, the Carbotect water test uses a more reliable 100 ml sample and, instead of seeking out microbial genetic materials themselves, looks for organic polysaccharide compounds, which are the nutrient building blocks that allow microbes to establish and become entrenched.

"While consulting on other issues for a municipal treatment plant, I discovered that the bio-matrix that makes up and protects biofilm is constituted mostly from organic polysaccharide compounds, which form the primary structure of the biofilm that enables bacteria to adhere and survive. So instead of looking at reactive tests for the bacteria themselves, I started looking towards a more proactive technique that looks for the building blocks that biofilm needs: the nutrient building blocks that allow microbes to establish and become entrenched," notes Kirkpatrick.

By detecting and removing the presence of the polysaccharide sugars, we can initiate the remedies necessary to 'starve' biofilm development, which in turn avoids complex cleaning issues becoming necessary further down the line," he explains.

The end result is Kirkpatrick's simple colour-based Carbotect test, which enables CIP effectiveness to be qualified based on a specific colour change that occurs, and semi-quantified against a standard chart based on the degree of colour change that occurs in a given time, typically five minutes.

"The test was geared towards low-skilled operators, because breweries and other plants operate on a 24/7 basis, while laboratories only work the day shift. So we needed a test that operators could do themselves: quickly, reliably and whenever they needed to," he says.

In an uncontaminated water sample, the Carbotect water test produces a bright pink colour. "As the reagent reacts with increasing levels of organic contamination, there is a progressive change from pink to purple; then to blue and green and ultimately to yellow, which indicates high levels of contamination.

"So 'in the pink' is where you want to be," he says, "and if some cider is still stuck in a dead end of some process piping, a non-pink colour will be produced, indicating that cleaning is not yet complete.

"And if biofilm is still being detected when rinsing clean equipment with supposedly clean rinse water, then there are likely to be exopolysaccharides associated with biofilm in the feedwater. Knowing this enables the source of contamination to be detected proactively, leading to a far faster and longer term solution to the problem," he informs *MechChem Africa*.

Originally developed for the ECA process, which is widely accepted as an effective CIP process today, the Carbotect test is rapidly gaining acceptance as an alternative to routine microbial laboratory testing and to the faster ATP (adenosine triphosphate) swab test, Carbotect's main competitor.

ATP testing is an onsite contamination test that relies on a minute water sample on a swab (µl) to verify the presence of microbial components. In comparison, the Carbotect water test uses a more reliable 100 ml sample.

"The ATP test is based on a luciferase enzyme, which is a chemi-luminescent substance that is activated when exposed to microbial genetic materials: DNA and RNA. The minute the contact is established, a chemical light reaction is triggered and a measurement of relative light units produced (RLUs) gives an indication of microbial contamination.

"It's not a test you can hang your hat on, however, because is it unreliable with respect to false negatives: due to the minute volumes being tested; and false positives: because organic materials that are not microbial in nature may also test positive.

"Another disadvantage of the ATP test is that a very sophisticated RLU reader is required. This instrument can cost between R20 000 and R50 000 in South Africa and, added to this, relative to the low-cost consumables in Carbotect test kits, there is a much higher cost associated with ATP swabs and reagents.

The Carbotect test has been independently verified by a Brewery which validated every positive Carbotect test with a separate three to five day micro-biological laboratory test, and vice versa. "The ATP test is entrenched, however, but we are making inroads into markets in South Africa, Namibia, Botswana and within Africa . We are also in discussions with a veterinary pharmaceutical company in the Netherlands," says Kirkpatrick.

In terms of applications, craft breweries are very interested and Kirkpatrick is also doing work in intensive livestock production, where biofilm not only causes diseases, but often causes blockages in drinking water systems.

"At the end of day, the Carbotect test is a low cost and invaluable tool for reducing the risks of delivering dangerously contaminated food and beverage products to consumers," Kirkpatrick concludes. ❑

Aquamarine Water Solutions extends services and reach

Clive Govender, executive responsible for strategy development and implementation for Aquamarine Water Solutions, a Murray & Roberts Group company, talks about a new approach to servicing water needs in Africa.

Originally headquartered in Cape Town, Aquamarine started out some 20 years ago to supply custom designed and locally built containerised treatment plants, mostly for filtering and desalinating seawater and brackish borehole water. "The company was privately owned and focused on producing desalination units for farming, industrial and commercial use, mostly small to medium sized membrane-based desalination plants that could be quickly deployed," begins Govender.

In 2014, the company was acquired by Murray & Roberts, which operated it relatively unchanged until last year. "Since early 2019, we have been on a mission to find ways of improving our offering to make it more relevant to the varied needs of the South African and African markets," Govender tells *MechChem Africa*.

Murray &Roberts operates from three platforms: Oil & Gas; Underground Mining; and Power & Water, which is where Aquamarine sits. Water plants and solutions are part and parcel of every one of these industrial platforms, however. "In principle, the Power & Water Platform operates in the SMEIPP (Structural, Mechanical, Electrical, Instrumentation, Piping and Plating) project space, and our water plants are no different. Aquamarine engineers operate in the same way as all of our other engineers and the Groups' extensive experience lends a lot of gravitas to Aquamarine's water solutions," he suggests.

In looking for ways to upscale and expand Aquamarine's business, the first decision taken was to incorporate the components needed to construct containerised water plants into the company's supply chain. "The providers of many of the components needed for our water plants exist outside of South Africa, and so we saw an opportunity to become the local partner for these technologies. Over and above using the components to manufacture according to our own designs and customer needs, we saw the opportunity of importing and promoting the products of some of the best suppliers in the world," says Govender, adding that all water plants require components such as membranes, pumps, valves, pressure vessels and tanks.

In addition, by standardising the components used, it becomes easier to improve the overall engineering underpinning the plants, while achieving fitness for purpose and economies of scale. "It also enables us to offer engineering support, servicing and long term maintenance solutions for our plants, giving operators the assurance of support across the lifetime of each plant," he adds.

In addition to components, Aquamarine has added the chemicals routinely used in water plants to its offering, starting with reverse osmosis membrane cleaners and anti-scalents. "We have recently been appointed as the sole distributor of the Aquatech range of MEMGARD® water treatment chemicals in South Africa and sub-Saharan Africa. These patented anti-scalants from the USA effectively control scaling species such as calcium carbonate, calcium sulphate, silica, barium sulphate and strontium scales, among others, and have shown to achieve up to 10% savings compared to alternative formulations," Govender points out.

Aquamarine has a long history of producing desalination units for farming, industrial and commercial use, mostly small to medium sized membrane-based plants that could be quickly deployed.

In addition, Aquamarine has ventured into the chemicals needed to maintain cooling systems and boilers, which are needed to keep process water pure enough and to limit the scaling on heat transfer tube bundles.

"We have also added an auditing service for evaluating the effectiveness of coolers or boiler systems and to recommend on-going treatment solutions. We are now in position to supply the chemicals as well as the dosing pumps required to keep the concentration levels ideal and we can also take care of the ongoing monitoring and management of the cooling and boiler water quality.

"These services can be uniquely tailored to enable operators to run their plants more efficiently and at significantly lower costs – and we are able to show how the costs of our services will be quickly recovered through cost savings," Govender assures.

These services are available for cooling systems for small to large and boilers from industrial packaged boilers all the way up to the utility scale boilers used to generate our electricity. "They have been particularly well received in hospitals, but we are also tendering on some of our grid-connected boilers for power generation," he adds.

A fourth arm of Aquamarine's extended service offering is maintenance for plant operators. "For the containerised plants that we deploy, we offer lifetime maintenance and we already have a very active team in Cape Town predominantly servicing water plants for the medical industry. The new maintenance option is now available to clients in any industry and this includes plants that were not initially ours. We have already picked up contracts to maintain plants where others have dropped the ball, which points in an encouraging direction with respect to how our engineering reputation and service has grown," he says.

Returning focus onto Aquamarine's own

Above: As part of its relaunched offering to the African water industry, Aquamarine's head office has relocated to Johannesburg, South Africa.

Right: The company is now using its experience to design a small standard range of brackish water plants; seawater plants; and solar powered plants that can quickly be customised and assembled to meet clients' specific requirements.

containerised plants, Govender says that the new philosophy is to use experience of purpose engineering to develop a modular, cost-effective range. "In the past we engineered individual plant to the nth degree, which has an advantage in that each plant becomes uniquely suited to its applications. But the approach it also expensive and difficult to scale.

"Now, we have used our experience to design a small standard range of brackish water plants; seawater plants; and solar powered plants that can quickly be customised and assembled to meet clients' specific requirements.

"These are all designed and tested and largely ready for deployment. When a client comes to us with a specific requirement, we can simply choose the number of standard modules needed to meet the capacity and then add any special requirements not included in the standard design," he explains.

"This is the beauty of the modular approach. We now have a manageable range of solutions able to meet over 80% of current and immediate future needs," Govender says, adding that Aquamarine still offers bespoke solutions that respond to specific customer requirements not met by the modular range.

The offering will soon be extended to include recycling and reuse plants. "Underpinning this strategy is the move towards local collection and reuse of onsite water, that is, keeping water onsite for as long as possible to reduce the load on municipal treatment plants and to prevent the costs and losses associated with transporting water from the point of collection to the point of treatment and then back to the point of use.

"We see long-term growth at commercial sites such as shopping centres where rainwater can be collected off the building's roof before being treated and reused in the bathrooms and kitchen facilities. We are leveraging off a US water reuse specialist to establish this range of plants, a company with an impeccable history in this area, having deployed hundreds of plants in several different countries around the world," Govender notes.

To make it easier for service providers across Africa to implement Aquamarine solutions, the company is offering a range of finance options to soften upfront investment barriers to implementation. "Of course, we can still offer Capex sales to customers wishing to invest upfront and take full ownership of our plants. In addition, however, we are offering two additional financing options," Govender reveals.

"Our design, build, operate and transfer option (DBOOT) is available to customers who prefer not to invest upfront. Instead, we agree a handover period and a monthly cost structure in advance. Aquamarine then constructs the plant and continues to own and operate it in a long term partnership for the duration of the agreed period, which reduces the risks to the operators and gives them access to our latest technologies. Ownership is then transferred at the end of the agreed period.

"An in-between finance option called design, build, transfer, operate (DBTO) is also available. Here, the operator takes ownership of the plant on installation, but responsibility for ongoing reliable operation rests with Aquamarine, which completely removes the risk of the owner ending up with an unreliable and unsuitable solution," he says.

Another key overall strategy, according to Govender, is to become significantly more responsive. "With respect to spares, we hope to be able to deliver within 48 hours from our warehouses in Gauteng to anywhere in South Africa, and in cases nearer to Gauteng, we hope to be to offer a same day delivery service.

"Also, though, with the standard modular plant offering, we are going to be holding pre-assembled sub-assemblies so that we can very quickly assemble and deploy a solution, hopefully within a few weeks of the initial order being placed.

"And because the solutions are mostly containerised, we avoid the uncertainty and risk associated with onsite construction. Pre-assembled and tested units simply have to be transported to site, offloaded, piped up and connect to power – and even this may be unnecessary if one of our solar options has been chosen," Govender concludes. ❑

Specially-tailored solutions for sugar sector

Bosch Projects integrates engineering technology and project management for power utilities and materials handling, commercial and industrial projects. For the global sugar sector, the company has tailored the Bosch Projects vertically-orientated reheater, which has produced some significant results.

"Bosch Projects, which has served the global sugar industry for over 58 years, offers a comprehensive service to customers, which encompasses strategic planning and feasibility studies; sugar technology selection; project structuring and funding; design and engineering; project delivery and operational support, and training," explains Steve Rosettenstein, sector director: sugar, Bosch Projects. "A critical part of our service to the sugar sector is in equipment design – from front-end cane off-loading, cane preparation and juice extraction, through to processing, sugar drying and refining.

The Bosch Projects research and development team works closely with associate sugar consultants and technologists around the world to develop high-performance equipment. Every system is designed to meet the client's requirements for cost-efficiency and improved productivity.

Although new equipment is designed combining the latest technologies and advanced manufacturing trends, Bosch Projects incorporates tried and tested technologies favoured by clients into new designs.

Over the past 20 years, the Bosch Projects Equipment division has developed an extensive range of sugar processing equipment, which includes the patented Bosch Projects chainless diffuser and continuous vacuum pan.

Other best-selling equipment includes rotary juice screens; juice heaters and clarifiers; cane preparation equipment; long tube evaporators and entrainment separators. Bosch Projects has also recently sold sugar dryers; refined sugar conditioning silos; continuous vertical massecuite reheaters; vertical continuous crystallisers and batch pans.

"The patented Bosch Projects Continuous Vacuum Pan (CVP) design has become the preferred system of many of the world's biggest sugar processing groups," says Neil du Plessis, sector manager: sugar equipment, Bosch Projects. "When supplying a CVP for C boilings, we recommend to clients that we provide the full C station, which includes the CVP, the continuous vertical crystalliser and the continuous massecuite reheater. By offering the entire system, we guarantee optimum performance of the total C station exhaustion."

Another system that has been well-received by the sugar sector is the vertically orientated Bosch Projects reheater, with significant performance benefits over conventional massecuite reheaters, which are horizontally orientated. The major advantage of the vertical reheater design is that massecuite rises as it is heated and thus follows natural convection tendencies. This results in favourable plug flow through the heater, thereby minimising the purity rise across the unit.

"Horizontal reheaters tend to have over-heated channels of massecuite near the top of the vessel and static cool areas at the bottom. This causes short-circuiting of massecuite inside the reheater, reducing the unit's efficiency," he adds.

The patented Bosch Projects Continuous Vacuum Pan (CVP) design has become the preferred system of many of the world's biggest sugar processing groups.

Projects around the globe

Bosch Projects recently supplied and commissioned six vertical massecuite reheaters around the globe and has submitted proposals for another four units to clients looking to upgrade their current designs. The units are fabricated from stainless steel, which minimises maintenance costs and reduces the need to treat the heating water.

The major advantage of the vertical reheater design is that massecuite rises as it is heated and thus follows natural convection tendencies.

The company has also developed the Lamella Clarifier, especially for the sugar industry, to satisfy demand for short retention clarification. Although various lamella clarifier systems are well-established in water treatment applications, this technology is new in sugar processing and is especially effective for juice, syrup and refinery phosphotation clarification.

The design of the new settling Lamella Clarifier reduces the size and footprint of conventional juice clarifiers by approximately 30%, significantly lowering capital investment costs. The system, which uses a series of inclined plates for fast, effective particle separation and settling, is much smaller than conventional clarifiers and substantially reduces liquor retention times.

Important features include short residence times, reduced sucrose degradation and improved turbidity removal. The highly efficient system, which operates with minimal moving parts, has low maintenance requirements.

The syrup clarifier is similar in design to the lamella juice version, except that it operates as a flotation clarifier, as opposed to settling. The system can be switched on and off as desired when syrup qualities are low and, because of its compact size, it can be easily installed inside an existing factory.

The Bosch Projects team works closely with its technology partners and fabricators globally to ensure manufacture of all equipment adheres to stringent international quality standards and exact design specifications. Clients are offered a full turnkey installation or stand-alone equipment can be supplied.

The company has an extensive network of offices in Africa, South and Central America and the United Kingdom. The company also has technology partners in the South East Asian region and the USA. ❑

Companies join together to produce protective masks

As an experienced technology provider for mask production equipment, Weber Ultrasonics AG now manufactures respiratory and surgical masks in Germany, with the help of the fast and active support of surrounding companies and the dedication of its own employees.

Ultrasonics is probably not the first thing that comes to mind when you think of respiratory and surgical masks. Yet ultrasonic welding plays an important role in making these products.

Efforts to stem the spread of COVID-19 have made one problem of globalisation clear, the dependency on low-cost manufacturing countries for personal protective equipment (PPE). This is why, in addition to protective clothing and gloves, breathing protection and surgical masks have been in short supply in Germany and other European countries since the global spread of the Corona Virus.

"Since the SARS pandemic in 2002/2003, we have been producing equipment for the manufacture of different protective masks made of nonwovens based on thermoplastic synthetics. The equipment is primarily supplied to customers in Asia," says Christian Unser, chief sales officer at Weber Ultrasonics AG.

Unser notes that producing masks was never an issue for the component and plant manufacturer based in Karlsbad, Germany – until the start of March 2020 when some countries started their shutdown.

He notes that what triggered the idea of mask production was an enquiry from a mechanical engineering customer who was unable to get filter domes for its special ventilated respiratory masks in FFP2 protection class, because of the export restrictions in place for these products.

"Together with the customer, we developed a plant design for producing the three-dimensional filter elements. The customer immediately placed a separate order for the three machines, which were manufactured by Weber, after seeing the production results," explains Unser. Parallel with this development, Weber Ultrasonics converted the design into one standard machine for the production of complete breathing protection masks. The first process step of deep-drawing the masks represented a challenge.

"This takes place through hot-forming, which requires a suitable tool as well as special heating elements and corresponding control units. In order to be able to produce corresponding prototypes quickly, we decided to turn to a market player that also works in this segment, who provided a heating element and control unit," he explains. "Our head of design at Weber Ultrasonics obtained a second heating element and control unit from his former employer to accelerate the production process. The necessary deep-drawing tool was made almost overnight by a neighbouring model maker and long-standing partner of the company. It was great to see how different companies offered spontaneous support and cooperation to put the necessary elements together," comments the chief sales officer.

60 respiratory masks per hour with one machine

The production of the breathing protection masks takes place with one standard machine in a multi-stage process. In the first step, an open-pored fibrebond used as a stabiliser, a layer of meltblown nonwoven as particle filter and a layer of spun-bond are shaped through hot-forming. The edges of the masks are then joined in an ultrasonic welding process. To do this, an ultrasonic converter converts the electrical signal produced by the generator into mechanical oscillation. This is transferred via a booster and a customised welding tool – the sonotrode – onto the surface to be joined. The frictional heat this generates causes the nonwoven materials to melt specifically at the edges, where they form a permanent bond without distorting. At the same time, the reliable, energy-efficient and productive joining technology ensures a soft and skin-friendly surface. The masks are then punched out mechanically, and tapes are attached to fasten them.

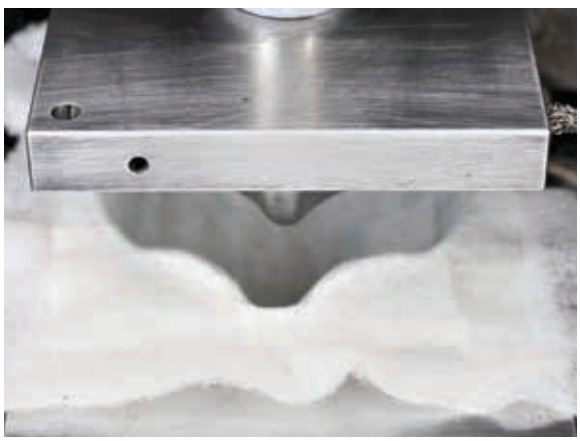
The production capacity of the compact standard plant with the single tool is around 60 breathing protection masks per hour. In line with current standards, Weber Ultrasonics aims to achieve protection class FFP3 for the masks produced and to perform an accelerated inspection of corona virus pandemic breathing protection masks for Germany.

For the respiratory masks produced according to the standards for protection class FFP3, an accelerated inspection of corona virus pandemic breathing protection masks for Germany will be carried out.

Unser adds that Weber Ultrasonics has also experienced increased demand for production equipment for surgical masks. The company's solutions in this segment so far enable the production of 200 masks per minute. "For this application we are currently working to set up a testing plant at our premises that will use a newly developed procedure for continuous ultrasonic welding. This will enable us to increase production capacity to 400, maybe 600 masks a minute," explains Unser.

The machine combines the steps of folding the fabric, integrating the nose wire, vertical and horizontal welding, welding on an elastic band and separating.

One reason for the fast implementation of the system in the factory in Karlsbad is the current travel restrictions. "We need to put the plants into operation virtually at our customers' premises and to do this, it is important that we have the same performance here in Karlsbad," says Unser. "This also has the positive effect that we can push forward developments directly on the plant, perform tests for customers and, above all, produce surgical masks in large quantities ourselves," he concludes. ❑



In order to start the production of the respiratory masks quickly, different companies supplied equipment for the deep-drawing process of the nonwovens.

Training as a strategy for good business

As part of its evolution as an agile manufacturer, Packsolve has placed more focus on the skills of its employees and their training opportunities. Even in the early stages, the company says the benefits are already very obvious.

As modernisation places new expectations on professionals, skills development is becoming more crucial, but remains a critical challenge in South Africa. As a responsible business, Packsolve has made it its mission to contribute to skills development, while developing the capacity for agile manufacturing and continual improvement.

In 2019, a group of Packsolve staff celebrated the successful completion of their training in the company's first learnership programme, which saw a skills transfer to equip staff with new knowledge for their current roles and for future growth.

Packsolve has made it its mission to contribute to skills development, while developing the capacity for agile manufacturing and continual improvement.

"Skills are a strategic pillar for us as an industrial packaging leader," says Doné Morkel, Packsolve's skills development facilitator. "Although we had a slow start, the benefits of the programme have become clear."

Mongezi Nkosi, from the class of 2019, says, "The learnership has had a good influence on the work culture and what people see and absorb. The classroom learning relationship was excellent, and the knowledge I gained has had a huge impact on my life."

His comment reflects what makes the learnership programme successful. Packsolve's people work closely together. The greatest challenge of modernisation is not in technology or processes, but in focusing a company's employees on a common goal. The agile culture a company must adapt to remain a market leader needs skilled and flexible employees. Strategic training has enabled Packsolve to navigate both requirements.

"Internal training is a practical way to see people's potential," says Morkel. "There aren't upfront expectations at this stage. The programme is there to see who wants to develop."

Morkel explains that the balance develops naturally because the programme follows an organic course. Among Packsolve's unionised workforce its appeal grew by word of mouth. The impressions improved union relationships, encouraging shop stewards to enrol as students in the programme.

The skills development facilitator explains that learnership programmes can often make the mistake of trying to be too many things from the start. Outcomes are sometimes carefully aligned to specific business roles or tax incentives like quotas, which may hobble an initiative before it can find its feet.

"Packsolve reserved some of the to-be-expected performance indicators and outcomes. It narrowed the focus to NQF levels 1,3 and 5 in 2018, then raised the first level to NQF 2 in 2019. ABET levels are also offered for employees who want to improve their foundational skills," she explains.

The programme is voluntary but is available to all Packsolve employees. At first, it had to overcome a lot of scepticism – only a small number of staff enrolled in the first group. But as they shared their experiences, interest grew and enrolment more than doubled by the next training season. Several of the graduates also returned to further their studies.

Those who enrol in the programme are given onsite training. They are also supported by Packsolve's management, who appreciate the strategic importance of skills training as being part of the business culture. To ensure the programme gets the right focus and support, Packsolve appointed Morkel to concentrate on the programme exclusively, allowing her to focus her energy and adopt a hands-on approach with the students.

"I'm always engaging with the students, talking to them and getting to know them. This is to make sure the programme runs well for them. One of the programme's goals is to promote Packsolve's strategy among workers, so it's important they feel the programme is for them and works for them," Morkel says.

Skills for tomorrow

Morkel explains that the programme's future goals aim to be representational and include more women on board. "Though manufacturing is a male-heavy industry, Packsolve has a considerable number of female employees. Several have already participated and graduated, but we need more women to seize this opportunity and join the classes," she says.

Packsolve is exploring how to align the programme with the manufacturer's overall strategy. It has already avoided many of the issues that dog other training. Instead of stapling skills onto the company, Packsolve has enabled learning to grow into a part of its cultural foundation. ❑

Product diversification in a changing economy

Although 'off-taker' market trends linked to digital transformation continue to negatively affect the printing and writing paper market-segments, demand for other products – such as certain grades of packaging and pulp, and dissolving wood pulp cellulose and nanocellulose – remains strong.

Nanocellulose, a cheap conductive material made from wood pulp.

The demand for recycled paper and tissue paper also remains strong. However, manufacturers need to look at current market trends and their influence on business to identify where opportunities exist to diversify their business around new product streams.

Some manufacturers, including paper and pulp company Sappi, have started to diversify their operations and product output, and have established themselves as world-leading producers of specialised cellulose, which is used in the manufacture and production of various consumer products across a diverse range of industries.

Sappi, in partnership with Edinburgh Napier University, has also developed a new low-cost process to manufacture what has been dubbed the 'wonder material' – nanocellulose – which has a number of potential applications, including vehicle manufacturing and energy storage. ❑

Promising start for Schuler automatic blanking press

An automotive supplier in northern Germany has successfully produced complex sheet metal parts on a Schuler MC 400 machine since the beginning of the year.

The Schuler MC 400 automatic blanking press has been in operation at Lang Metallwaren since the beginning of the year.

At its site in Woldegk near Neubrandenburg, Germany, Lang Metallwaren produces stamped and deep-drawn parts in small and large series for customers such as BMW, Valeo and Webasto. Because the products are becoming increasingly complex, the automotive supplier required longer dies for the increasing number of forming steps, and therefore a press with a larger clamping surface.

Lang Metallwaren requested the Schuler MC 400 automatic blanking press with a table size of 1 400 to 3 000 mm, from the leading manufacturer in sheet metal, which has been in operation in the newly built hall.

"We now achieve significantly higher output rates on the Schuler automatic blanking press," reports plant manager Jörg Monsig.

Although the products, made of stainless steel and other heat-resistant metals, are relatively small with an average size of 100 to 200 mm, they combine an increasing number of functions in line with customer requirements.

Lang Metallwaren's existing machine park also includes a 160-ton and a 250-ton press from another manufacturer. Compared to the other manufacturer, set-up on the Schuler machine from die to coil is faster, says Monsig. "The coil loading chair simply saves time. Thanks to a touch-sensitive monitor with a diagonal of 18.5 inches, the system can be operated intuitively and easily, allowing employees to familiarise themselves with the machine in a very short time."

Monsig adds that he is also satisfied with the progress of the project adding that it worked out perfectly for the company. "Because of site-specific conditions for the foundation, the schedule had to be taken back by some time before the project started."

With automation by robots and other acquisitions, the plant manager has gradually made the site fit for the future. For Monsig, Schuler's automatic blanking press represents a further investment in the company's competitiveness. "We already have initial orders for the new press until the end of the year, and naturally we hope that this will lead to many more," he concludes. ❑

Stamped and deep-drawn parts combine an increasing number of functions at the request of the customer.

Multotec centrifuge excels in food sector

Well known in the mining sector for dewatering and other mineral processing solutions, Multotec Process Equipment has also been growing its footprint in food and chemical applications.

A recent installation by the South Africa-based original equipment manufacturer (OEM) successfully assisted a salt producer in Namibia to reduce moisture content in its product. According to Multotec Process Equipment senior process engineer Khathutshelo Mutshinyalo, a fit-for-purpose vibrating centrifuge was the answer in this application.

"The customer had a specific requirement to achieve a low moisture level in its coarse salt application," Mutshinyalo says. "However, we also needed to prove upfront that our solution would deliver the correct result."

With its experience and its in-house testing facilities, Multotec was able to define a test work method to meet the customer's precise needs. It was also able to draw on the capabilities of its state-of-the-art Centrilab technology, developed by sister-company Siebtechnik Tema. The Centrilab tests the separability of suspensions in the centrifugal field by simulating the particular centrifuge operating conditions.

"This allowed us to specify the optimal machine for the customer, and prove the results before the order was placed," he says. "The vibrating centrifuge we specified features a maximised area inside the housing, to optimise the dewatering process."

The result was that Multotec's centrifuge achieved a moisture content 10% better than the customer's expectation. Achieving better than the desired moisture content ensures there is minimal to no formation of lumps in the product, which saves the customer potential penalties.

"By testing to ensure the right solution, and deploying a product specialist and technician on site, we could commission the centrifuge outside South Africa within a week," he says. He notes that Multotec's footprint with this technology includes companies in South Africa, Botswana, and Kenya using it for similar applications. ❑

Khathutshelo Mutshinyalo, senior process engineer, Multotec.

Multotec was able to define a test work method to meet the customer's precise needs with its experience and in-house testing facilities.

Zest WEG adds geared motors to product line-up

A range of Zest WEG geared motors – with benefits including efficiency and reliability – will soon be available to customers in South Africa and the rest of the continent.

According to Zest WEG national sales executive, Johan van Niekerk, the WEG WG20 range is a natural extension of the company's offering in electric motors, and will be available from the third quarter of 2020. The geared motors will be distributed and supported through Zest WEG's established footprint of strategically located branches and outlets across the continent.

"In keeping with our local production philosophy, and to reduce lead times to customers, the geared units will be assembled in South Africa," van Niekerk says. "Zest WEG has made a substantial investment in new assembly facilities, including hydraulic presses and assembly tooling."

He also notes that the geared motors will allow the company to expand services in new markets including the packaging, recycling, and food and beverage sectors.

Cas de Jager, Zest WEG geared motor specialist, explains that key improvements delivered by geared motors are a high level of efficiency and turnaround time. He says, "Only about 1,5% of mechanical efficiency is lost per gear stage, so a two-stage gear unit would be about 97% efficient. The geared motors are also reliable and durable, making them economical to maintain.

"Underpinning our quick turnaround time are our skilled employees and local stockholding of a full range of gears, flanges, housings, shafts, bearings, oil seals and other components," he adds.

The components for the geared motors are manufactured by Watt Drive in Austria, an established gear technology specialist and part of the global WEG group. Watt Drive offers a complete range of combinable drive systems for production machines and industrial manufacturing plants. In addition to providing high quality components, the company also trains Zest WEG personnel at its Austrian facility and will regularly send technical experts to continue building capacity in the South African operation..

Parallel shaft gear units are particularly suited for conveyors.

www.zestweg.com

Booyco on track with deadline for proving Level 9 safety

In the light of impending safety regulations governing South African mines, South African-based Booyco Electronics is well advanced in testing its proximity detection systems (PDS) to comply with Level 9 safety standards.

The importance of this testing arises from recent changes in Chapter 8 of the Mine Health and Safety Act, which requires mines to take 'reasonably practicable measures' to prevent collisions between trackless mobile machines (TMMs) – as well as between pedestrians and TMMs.

Past measures implemented by mines have included systems that warn pedestrians of their proximity to TMMs (Level 7) and systems that deliver an advisory instruction to TMM operators (Level 8).

"The Level 9 standard raises the bar significantly, requiring electronic PDS systems to take mechanical control of the TMM and automatically bring it to a stop when a dangerous situation is detected," says Booyco Electronics CEO Anton Lourens. "This elevates what is traditionally called a PDS into what is really a collision avoidance – or collision management – system."

Significantly, Booyco Electronics was the first company to begin Level 9 testing in South Africa, which is conducted by the University of Pretoria's Vehicle Dynamics Group. The tests are aligned with the international standard ISO21815. It is expected that regulations regarding Level 9 compliance will be finalised by the end of 2020.

Booyco Electronics is well advanced in testing its proximity detection systems (PDS) to comply with Level 9 safety standards.

www.booyco-electronics.com

Temperature dry-well calibrator with light, compact design

WIKA's innovative CTD4000 series calibrators have been designed for on-site applications and for the severe conditions of the naval and marine sectors.

Their ease of use and compact and practical design make them unbeatable in industrial processes where the calibration of the temperature measurement systems is essential for control of the process and quality of the final product.

Special attention is paid to reduce weight and size, and to reinforce robustness by using an aluminium body as well as aluminium and stainless steel for many internal parts.

With their available standard inserts, the calibrators are versatile and can easily be adapted for the calibration of temperature probes with the most common diameters.

Customer-specific inserts and bores are available on request.

www.wika.co.za

Skid-mounted dry-type transformer does duty on coal mine

In a specialised application on a coal mine, Trafo Power Solutions recently supplied a dry-type transformer mounted on a mobile skid.

"We specially designed a fit-for-purpose solution for the harsh environment of the coal mine," says David Claassen, managing director at Trafo Power Solutions.

"The cast-resin dry-type transformer is ideal for the mobile arrangement as it is cooled without oil," he explains. The absence of oil makes it a safer option against fire hazards, especially on a coal mine. It is also more environmentally-friendly, as there is no chance of an oil spill. The 1250 kVA dual-MV configuration supplied to this mine allows the unit to be linked up to either 11 kV or 6,6 kV supply.

"The unit was designed for a compact enclosure, while allowing for sufficient air movement for cooling," Claassen says. "We provided a unique solution of a cast-resin transformer with Class H insulation rating for both the medium voltage and the low voltage windings."

Fully enclosed mini-sub including cast resin transformer.

This insulation standard ensures that the transformer can withstand temperatures of up to 180°C. He notes that the enclosure design had to accommodate these heat factors while also preventing the ingress of dust or water.

Special engineering was also applied to building a high level of mechanical rigidity into the transformer itself, as demanded by the regular relocation of the mobile skid. This movement means considering that vibration and other forces must be borne by the equipment without affecting its performance.

Claassen emphasises that Trafo Power Solutions is experienced in providing dry-type transformers in a range of enclosed formats to suit customers' needs. The inherent safety of these transformers also allows them to be installed in underground mining locations.

www.trafo.co.za

Essential lubrication for wastewater treatment plants

A significant but often forgotten tool for getting the longest, most effective performance out of wastewater treatment equipment is good lubrication. Lubrication is especially significant in wastewater disposal systems, where lubricants are constantly stressed, diluted or destroyed by sand, dirt, acids, extreme temperatures and the dynamics of the chemical processes involved in treating water. A selection of quality lubricants is the key to reducing energy consumption, prolonging equipment life, and reducing associated costs.

Callum Ford, national marketing manager at Lubrication Engineers (LE) South Africa, says that the primary job of a lubricant is to overcome friction. "We advise our wastewater treatment customers to use the lightest possible lubricant consistent with their desired application," he says. The best lubrication and least amount of friction will come from the thinnest lubricant that still has sufficient film strength to carry the required mechanical load.

Electric motors, gear reducers, chain drives, pumps, air compressors and engines are some of the key pieces of equipment at a plant that need carefully managed lubrication. Basic products needed in a wastewater treatment plant are electric motor grease, tough multipurpose grease, EP gear oil, R&O turbine oils and engine oil. There may be more than one viscosity of gear oil required, as well as two grades of turbine grade industrial oil and lighter or heavier grades of other products.

Importantly, in a price-sensitive market like South Africa, some products can be used in multiple applications at a plant. Cross recommendations can be made, such as using gear oils for oil-lubricated electric motors and some turbine oils for gears. Turbine oils are also often used in most other-oiled points. Ford says that working closely with a lubrication partner is key to finding a balance between performance and budget requirements.

www.lubricationengineers.co.za

Cross recommendations can be made where oil products are used in multiple applications, such as using gear oils for oil-lubricated electric motors and some turbine oils for gears.

Oxygen analyser ensures quality of N_2 for oil and gas

A major supplier of nitrogen generators has selected Michell's XTP601 oxygen analyzer to ensure N_2 quality as part of its engineered systems for the oil and gas industry in the middle east.

The containerised or skid-mounted nitrogen generating systems have to withstand the large variations in ambient temperatures found in deserts and tropical areas which range from below freezing to over 55 °C. In addition to the wide temperature differences, the systems also have to cope with the harsh, corrosive environments found in coastal and offshore installations.

Michell Instruments, locally represented by Instrotech, offered the XTP601 oxygen analyzer for the application because of its unique design with no moving parts or consumables, enabling the instrument to operate reliably and efficiently in harsh conditions.

Its compact size and integrated HMI makes it easy to install into the N_2 generator and simple for operators to interrogate once in use. ***sales@instrotech.co.za***

Strategies for synbio success

Michael Holman, research vice president of global primary research and technology innovator, Lux Research.

Synthetic biology (synbio) has emerged as an alternative to traditional petrochemical synthesis for applications in agrifood; beauty and personal care; chemicals; and consumer products. *MechChem Africa* presents findings from the executive summary of a report by lead analyst, Gihan Hewage, and research vice president, Michael Holman, from global primary research and technology innovator, Lux Research.

According to Gihan Hewage and Michael Holman, writing in the executive summary of Lux Research's Synbio strategy report, effectively using synbio capabilities requires understanding the right strategy for each of the distinct value propositions it can offer, including marketing benefits, environmental benefits, novel products, and cheaper and more flexible production.

As the next decade unfolds, synbio strategy will evolve from creating niche products with 'green' credentials, to creating new molecules not accessible with current technology and new capital-light business models based on strain development and fermentation as a service.

With respect to synthetic biology's potential for producing chemicals, the authors note that while traditional petrochemical synthesis has led to the commercial-scale production of numerous chemicals and materials, the limitations of the technology, as well as both real and perceived ill effects, have led researchers to prefer to explore biological routes.

"Biological catalysts (enzymes), however, offer better reaction rates, selectivity and yields; they don't require high temperatures or pressures; and can convert biomass, waste or other more environmentally friendly feedstocks – using only reactants of 'natural' biological origin," argue Hewage and Holman.

"Over the past decade, biological tools from genetic engineering to DNA synthesis have been developed to enable the creation of organisms that use fermentation to produce a variety of desired molecules from sugars or other biological feedstock. As a result, interest and activity in this approach, called synthetic biology (or synbio), has grown, creating billion-dollar companies and generating a flurry of innovations," they add.

But synbio isn't a panacea, warn the Lux researchers. "Not all syntheses are amenable to fermentation and targeted use might not be a fit for one of two reasons:

- "Microorganisms may not be able to metabolise the desired feedstock. While this may provide a challenge for some feedstocks, such as crude oil, microbes naturally metabolise sugar to produce a wide variety of chemical targets – and many types of biomass can be converted to sugars.
- "Genes may not exist to produce the target compound. Although microbes can be readily genetically modified to produce a wide variety of compounds, some lack the genetic code for production. It may be possible to develop the necessary genes, but some molecules are more accessible than others."

They argue that synbio works particularly well for:

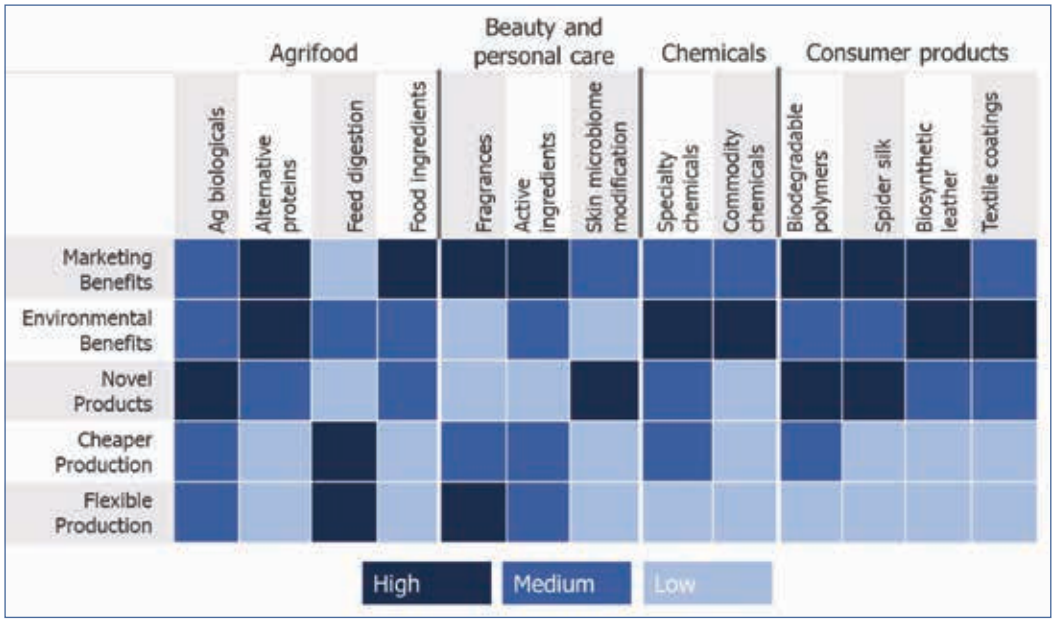
- Naturally occurring products. If genes for the target are found in nature, they require less effort to make via microbial fermentation.
- Enantiopure products, that is, substances consisting of two mirror image components. Biological catalysts are highly effective at producing just one of the two possible mirror images of a molecule, which is often important for drugs and other active ingredients.

On the other hand, synbio does not work as well for:

- Inorganic compounds. Microbes are generally best at converting a carbon source to a carbon-containing product.
- Hydrocarbons. Most fermentation feedstocks – from sugars to CO_2 – are oxygenated carbon compounds. Making pure hydrocarbons is less efficient due to the need to remove oxygen.

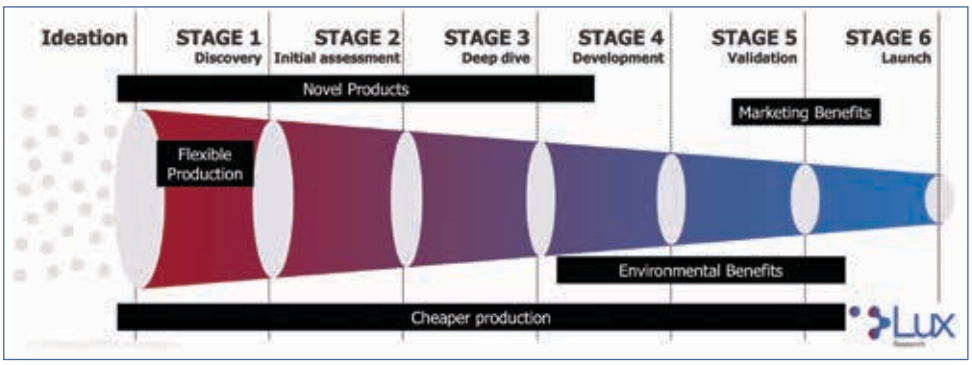
Value propositions in industrial and consumer applications

"The ability to engineer microbes to produce chemicals on command is heady stuff for a technologist, but what is the business case for using a synbio approach over long-established traditional synthetic chemistry? From our conversations with key players, ranging from startups to large companies across a variety of industries and regions, we've identified the following value," write the authors, noting that the full report dives into each of these key value propositions.



An assessment of the relative benefits of synbio production for chemical products for different market sectors.

- Marketing benefits: Products can be marketed as 'natural' or 'bio-based', without emphasising environmental advantages.
- Environmental benefits: New production routes have decreased environmental impacts over incumbent routes, especially with respect to decreased carbon footprints.
- Novel products: For certain applications, synbio can make products that have no existing manufacturing route. These products may have improved performance over incumbent products – but not necessarily.
- Cheaper production: Synbio routes can result in cheaper costs relative to incumbents.
- Flexible production: Simply switching out the microbes in a given fermenter means producing a new compound with equipment changes or plant redesign, allowing for small-volume production of numerous different compounds and/or changing production based on market demand.



Lux Research's synbio innovation funnel of different value propositions at different stages of maturity.

Synbio fermentation processes use renewable feedstocks as opposed to fossil fuels, and production can have decreased environmental impacts, including a reduced CO_2 footprint and less use of toxic compounds.

In addition, reduced environmental impact has been used as a value proposition across most target industries for fermentation, notably chemicals, textiles and apparel, and agrifood.

There are challenges to overcome, however. "Companies have struggled to commercialise environmentally friendly products in the past, leading to challenges with internal interest. Some processes may use more energy and water than incumbent routes," the report notes as examples.

On the plus side, though, Impossible, the vegetarian meat substitute manufacturer, claims that synbio-derived leghemoglobin requires 96% less land, 87% less water and results in 89% fewer GHG emissions compared to beef production.

In addition, the bio-plastic producer, Braskem notes that fermentation-derived polyethylene (PE) effectively removes CO_2 from the atmosphere, making it a carbon sink.

For chemicals, environmental benefits stand out as the most applicable value proposition for fermentation routes. The prospect of using biomass as an input for chemical production can reduce CO_2 emissions and help drive adoption in an industry undergoing increasing scrutiny for poor environmental footprints.

Given that specialty products are smaller-volume, there is potential for cost reduction of existing products, exemplified by Genomatica, which uses cost reduction as a value proposition for its 1,4-butanediol and caprolactam.

There are also opportunities to develop novel chemicals using fermentation, such as succinic acid and furandicarboxylic acid (FDCA). Novel chemicals are, however, best targeted for specialty applications, as challenges with scale and market development have led to numerous failures for those targeting commodity chemicals from fermentation.

Key production strategies

There are two key strategies for flexible production. The first is imitating contract manufacturing organisations (CMOs) – or semiconductor fabs – in providing production services to other companies. Companies can specialise either in developing their own strains or in running those strains on fermenters in flexible facilities, maximising capital efficiency and leveraging each type of expertise separately.

The second is using synbio's flexibility to optimise and arbitrage one's own product portfolio, either using a single fermenter to make a year's worth of different products over a short amount of time or changing microbes at a given fermenter depending on market demands. The latter strategy would require either having a library of strains on hand or the ability to rapidly develop strains.

In addition, companies could use feedstock flexibility to expand to regions with different input availability.

Conagen: a case study

Strain developer, Conagen, recently announced it had developed strains to produce upwards of 20 rare lactones for flavours and fragrances. While the company has not yet produced any of these lactones at commercial scales, similar downstream processing conditions allow flexible production at scale.

Lux Research believes that Conagen is well-positioned to use the flexible production value proposition for its lactones, since these products are small-volume and used in the same applications. However, the biggest unknown is whether or not Conagen will need to use flexibility. If market demand is skewed toward a small fraction of the lactones, flexibility will become less relevant.

"Setting out a full synbio strategy requires understanding not just of how to act, but when. Different value propositions will be realised at different times, as the mapping to the innovation funnel shows," the report suggests, while pointing to its funnel diagram of the different value propositions at different stages of maturity.

Summarising the development pipeline, the report predicts that over the first half of the 2020s, small-volume products using marketing benefits as a label will continue to be launched. "Because production is not well-established, the two most important factors in this validation phase are feedstock and infrastructure. Players that can establish a feedstock source and production capacity will beat out those that are unable to secure either," the authors note.

Due to the relatively low numbers of players, the microbe and market will not matter as much – the players that bring products to market are not competing with other fermenters, but with established markets.

Small-volume applications with minimal regulatory hurdles, such as beauty and personal care, will be first to market. Others, such as food ingredients, will have opportunities to prosper if users can steer clear of regulatory issues, while markets must be developed for agricultural biologicals and biodegradable polymers, which are both applications that have downstream interest.

Marketing benefits will be the dominant value proposition, while environmental benefits will start becoming more important. Cheaper production will play a role in a few select cases where it's most easily achieved.

"At this stage of synbio's technical development, owning and operating a facility, rather than using contract manufacturing, will make the most sense. While outsourcing production is an appealing strategy that requires less upfront capital, the greater control and process knowledge from running one's own facility is more likely to be successful while the technology is less mature," is the concluding advice of the reports executive summary. ❑

Manufacturers need to prioritise water security

Heiner Freese of SBS Tanks argues the case for a much stronger focus on water security in South Africa's manufacturing sector.

A lack of a consistent and reliable water supply is having a big impact on the growth and profitability on many businesses in South Africa – particularly those in the manufacturing sector – and these businesses need to act swiftly to implement measures and solutions that are going to mitigate water security risk and better prepare them for an uncertain future.

According to the World Bank, with roughly 663-million people lacking access to drinking water and 2.4-billion people worldwide still lacking access to sanitation, water security is still considered to be one of the biggest global risks.

But, it's not just individuals who are suffering.

Heiner Freese, chief operating and financial officer at SBS Tanks notes that here in South Africa, water security has become an ever-increasing business objective and a concern for every citizen as the climate continues to change and continued water supply challenges at municipal level become ever more evident.

No surprise, then, that across a variety of environments, including those in which SBS Tanks specialises – such as mining, fire protection, municipal, manufacturing, food and beverage, healthcare, hospitality and property development and management – there has become a greater need to mitigate the risks associated with water security.

This has been driven home by the fact that South Africa has a growing population and a developing economy currently under financial pressure, and these factors can only increase the pressure on the country's water supply system, which, in turn, is already suffering from years of neglect and poor maintenance.

As a result, many businesses should be – and some already are – looking at creating their own water supply to avoid disaster and take control of their own destiny, rather than rely on the traditional water authorities to supply water.

Additionally, the cost of water has increased drastically and will continue to do so, making the collection of rain water and the harvesting of water from unused resources just a couple of examples of where the return on the investment in water storage solutions can start to make economic sense, while providing continued supply that may otherwise not be guaranteed.

Nearly all industries require water, even if it is just drinking water for employees. Liquid storage tanks are a safe way to store water and if one looks at the water provision process, tanks are a common occurrence in any system, from extraction from rivers right through to storing wastewater for recycling.

Further, process water – water that cannot be classified as drinking water and is used in connection with technical plants and processes in production companies – is an important ingredient in many products, with water also often used in the cooling process of many manufacturing plants, such as the cooling of furnaces in steel manufacturing.

Liquid storage tanks are a safe way to store water and if one looks at the water provision process, tanks are a common occurrence in any system, from extraction from rivers right through to storing wastewater for recycling.

It is here, within non-food manufacturing environments, notes Freese, that mitigating water security issues is crucial and becomes a safety concern. In these areas it is highly likely that a furnace for instance, that does not have sufficient water for cooling could explode, threatening life and property.

Taking that thought a step further, fire is a threat that affects all businesses and it is becoming more common in new developments of both warehousing and residential accommodation that insurers require property owners to provide for and install sprinkler systems and standby water tanks.

Throw in the fact that in South Africa we are starting to hear more and more about 'water shedding' – as opposed to load shedding – and you have a scenario that requires responsible businesses to build in contingencies, such as the installation of water tanks, which have the ability to mitigate the risks of low water pressure, water shedding, or even no water being provided through the municipal water system.

www.sbstanks.com

SBS Water storage solutions

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