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## Festo App World and Motion Terminal launch

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# Industrial waste, biomimicry and the circular economy

Peter Middleton

## COMMENT



In this month's Innovative Engineering feature, Claire Janisch of biomimicrySA presents the case for adopting a more 'life-friendly' approach to business and industry, one that does not result in dumped toxic waste materials and contaminated land, air and water resources.

"We can make almost everything in chemical engineering in ways that are nourishing to life. Almost every functional material or process has a counterpart in nature that uses life-friendly materials, low energy processes and continuously cycles all the materials used, including water and carbon," she says in introducing the concept of biomimicry.

Industrial processes, she argues, tend to be massively energy intensive compared to natural processes, which have evolved over millions of years to be amazingly efficient and very resilient.

Industrial processes, if the cost to the environment is fully accounted for, also prove economically unviable. Citing an Ecosystems and Biodiversity (TEEB) programme sponsored by the United Nations Environmental Program, Janisch notes that none of the world's top industries would be profitable if they paid for the natural capital they use. The TEEB programme calculated the total unpriced natural capital consumed by the 1 000-plus industries studied to be US\$7.3-trillion per year, equivalent to 13% of global GDP in 2009.

"In comparison, naturally evolved processes integrate all externalities, yielding system-level efficiencies," she points out. Ecosystems such as forests, grasslands and coral reefs survive for centuries, cycling all materials, building soil, cleaning water and generating only the gases that support life.

"Using biomimicry as a model, measure and mentor, it is possible to emulate nature's ecosystems in many ways, which is why biomimicry and the circular economy go so well together. This is simply a better and more logical way to design and manage our systems to emulate the nourishing systems that support all life," says Janisch, before citing several examples of how this has already been done.

When applied to how we humans use natural resources in industrial processes to satisfy our ever-expanding 'needs', the circular economy is a development model that strives to use the waste from one process as the raw material of another. Our SAChE IChemE member profile in this issue follows the career of John Bewsey who, in recent years, has been exploring ways of applying this principle to water treatment, including acid mine drainage (AMD), industrial wastewater and domestic effluent.

Bewsey's patented treatment systems are built

around the idea of transforming the inorganic salts polluting treated AMD, domestic sewage, industrial wastewaters and underground 'brakwater' into high-value fertilisers, while leaving the water completely demineralised.

"Sodium salts are particularly hazardous," says Bewsey, because clay particles absorb sodium ions, which makes the soil impermeable and causes the flora and the soil beneath it to die.

His ion-exchange treatment process uses two lines of stirred tanks with the contaminated water and the ion exchange resins flowing in opposite directions to each other. This process produces demineralised water, but the resins become contaminated, one with the positive salt ions (cations) and the other with the negative anions.

By regenerating the CATEX and ANEX resins with nitrate and ammonia, respectively, Bewsey's process produces a nitrate blend. Sodium carbonate is then added, which enables ions such as calcium to be removed, leaving a sodium nitrate solution. This is mixed with potassium chloride and evaporated, which enables the dangerous sodium chloride to be removed from the water, leaving a potassium nitrate (KNO<sub>3</sub>) solution, which is dried into granules to give "a valuable fertiliser with global demand".

By benefiting almost all of the contaminants in the water, the water treatment itself can become a profitable process rather than a grudge expense. More importantly, though, harmful pollutants in the water are transformed into valuable fertilisers.

A few months ago, we published the story of OMV Gypsum, which reprocesses waste gypsum from a phosphate fertiliser plants to make very high quality finishing plasters for the building industry. Some fertiliser plants still pump their waste into the ocean, but with the OMV initiative "we can now solve this problem by creating a genuine zero waste value chain from agricultural fertilisers all the way to high quality, modern building materials," says the company's MD, Oscar Goudriaan.

Bewsey tells a story from his early career about a milling technique he developed to improve the efficiency of a pharmaceutical ingredient. It was deemed too expensive by the company directors however, so he found a secondary use for the investment, grinding fire extinguisher powder. The company directors were horrified: "a pharmaceutical company cannot make fire extinguisher powder!"

Yes they can, and if more industries realised this and adopted circular economy and life-friendly approaches, their businesses, our lives and the environment would be better for it. □

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# Festo sets high industry standards with new

## App World and Motion Terminal VTEM launch in South Africa



Adrian Bromfield, Head of National Sales at Festo South Africa.

Each year Industry 4.0 introduces new innovative digital approaches in the automation industry. These digital advancements continue to reshape the automation industry in ways that encourage customers to seek new and effective ways to achieve game-changing outcomes and remain a step ahead of the competition. The advancements introduced by Industry 4.0 constantly translate into a range of opportunities in the automation industry. One company grasping these opportunities is Festo. After carefully analysing the market and customer needs Festo launched a digital platform called App World. The App World is an online platform for purchasing and downloading Festo software/licenses.

With this platform, Festo aims to simplify

Festo has recently launched a digital platform called App World. It is an online platform for purchasing and downloading software/licenses and is aimed at simplifying the lives of customers in the automation industry that are moving into the digital Industry 4.0 space.

the lives of customers in the automation industry, with a special focus to customers moving into the Industry 4.0 space. The Festo App World is available for all Festo account holders that wish to purchase this digital platform. Keeping convenience in mind, Festo has allowed customers to use their Festo Online Shop user login to purchase on the App World platform ([www.festo.com/appworld](http://www.festo.com/appworld)). App World comprises of engineering tools (FluidDraw P6 and Schematic Solution EPLAN project), Smartenance, Condition Monitoring software and an expansion package for the Servo Press Kit YJKP. As automation experts, Festo is combining its extensive knowledge of industrial applications with the latest digital advancements to realise such apps for industrial automation practice.

**A breakdown of the software that's available on App World: Festo Motion Terminal (VTEM) and apps**  
The launch of App World was followed by the

much-anticipated launch of the Festo Motion Terminal VTEM in South Africa. The Festo Motion Terminal is one of the first products of the Industry 4.0 era to combine digitalisation and pneumatics. This VTEM is an intelligent fusion of mechanics, electronics and software such as pre-setting of travel time, Eco-drive, start package, leakage diagnostics, model-based proportional pressure regulation and proportional pressure regulation.

The Festo Motion Terminal combines the functions of over 50 individual components: this simplifies the engineering process and enables numerous hardware components to be dispensed in one product. Maintenance is also simplified, as long lists of spare and wearing parts will be greatly reduced due to the internal control of your application.

With the Festo Motion Terminal VTEM and software from the App World combined, machinery and plant manufacturers can benefit from completely new designs for platforms and modules. Plant operators can gain a competi-



Digital maintenance app Smartenance for system operators and production managers in the automation industry.

# digital apps for the automation industry



*The Festo Motion Terminal VTEM is ushering in the digital era of pneumatics.*

tive advantage thanks to flexible and adaptive systems, data transparency, communication ability, extreme process reliability and simpler operation of complex machinery. Adrian Bromfield, national sales manager of Festo South Africa & Nigeria, says: “We have created an automation platform that integrates all functions so that adaptive and flexible production is made economically feasible, and we have revolutionised pneumatics in the process.”

## Smartenance – Mobile Digital Maintenance Manager

Preventive system maintenance is a time-consuming process which is shockingly still documented using pen and paper. Festo Smartenance puts an end to this. The software program from Festo is a digital maintenance manager for production managers and system operators.

Festo Smartenance consists of two parts: A mobile maintenance calendar as an app for smartphones and tablets and a web browser interface (dashboard) for production managers. The dashboard, with which the maintenance tasks will be managed and documented, can be accessed conveniently with a web browser and the app can be downloaded and installed from IOS, Android and Windows.

The advantages of digital maintenance are obvious: The system operator always has the maintenance calendar of his or her machine on a mobile device at hand and receives all necessary information on the tasks directly on smartphone or tablet. The production manager can monitor all his or her plants on one Dashboard and can see at a glance which tasks urgently need to be completed or what feedback has been sent by colleagues regarding possible problems

or delays. With Smartenance, coordination effort can be reduced, and work can be done more efficiently.

## Expansion package for the Servo Press Kit YJKP

This software simplifies several applications in the electronics industry. The configurable servo press kits can be tailored to the needs of the user, guaranteeing a flexible design and reducing investment costs. Customers do not need to be next to the press kit to control it. They can connect it online through the OPC-UA terminal and control it manually.

## Condition Monitoring Library for Compact Handling System YXMx

In this digital world, all equipment and machinery are expected to provide maximum availability and reliability. The condition monitoring software helps to plan maintenance work professionally while cutting the associated costs at the same time. In addition, it allows customers to analyse the production process and offers comprehensive energy monitoring. This software enables systems and components from various manufacturers to be easily integrated into one solution.

## Engineering software: FluidDraw P6

Now even better, Festo FluidDraw provides fast and standardised documentation of machines or systems. With the new FluidDraw P6, customers can create pneumatic and electric circuit diagrams even more reliably and efficiently. In addition to new features and a redesigned interface, the flexible licence models will help to find the right licence for different applications.

FluidDraw makes it easier to plan complete systems and integrate individual components. Customers can access the Festo catalogue using their own imported databases, and thus benefit from reporting functions and ready-prepared assembly drawings.

## Engineering software: Schematic Solution EPLAN project

For an individually configurable product such as a valve terminal, finding the right EPLAN documentation used to be a tedious task. The type codes of the valve terminals first had to be broken down into parts before they could be used to find the individual macros. The individual macros then had to be relinked into a complete set of documentation. This is no longer the case as Festo offers a web service via the Festo App World for automatically creating a correctly configured EPLAN project using the type code. What used to take hours and was prone to errors can now be done in just a few minutes, without any errors and according to standard.

The changes brought forth by industry 4.0 advancements increase productivity as well as turnover. As leaders in the automation industry, Festo is proving to help customers easily achieve this through the launch of App World and Motion Terminal VTEM (the first valve to be controlled by apps) in South Africa. “Customers can now conveniently operate their machines using the Festo apps with just a touch of a button either on their smartphones or computers”, concluded Bromfield. Festo is more than just a supplier of innovative solutions, it is a company that provides customers with digital solutions today, for the world of tomorrow and ensures that customers are ready for Industry 4.0. □

# Careering towards the circular economy

*MechChem Africa* profiles plant and process innovator, John Bewsey, a Fellow of SAIChE and IChemE who, across his career, has been granted over 25 chemical technology patents covering an application range from fertiliser nutrient processing to industrial processes and waste recovery.

“I was born into a family that had absolutely no idea that water was H<sub>2</sub>O, but I seem to have been given the gift of chemistry. Even at school I was part of a science society and was giving talks about how to make plastics and how to brew beer,” Bewsey begins.

Also good at fixing things, when it came to choosing a career chemical engineering made more sense to him than the pure chemistry options. So after matriculating from Bishops’ Diocesan College in Cape Town, Bewsey attended the University of Cape Town, from which he graduated in 1963 with a BSc in chemical engineering.

Seeking out the more practical side of the discipline, he went directly to work at the pharmaceutical manufacturer, Petersen (Pty) Ltd, in Epping, now called Fine Chemicals. “We made Codeine, Paracetamol and a host of other simple to make active pharmaceutical ingredients – which Fine Chemicals is still making these today,” he says.

“Within three months of graduating, I was promoted to manager of the plant, which I was running from 5:00 am to well past 7:00 pm. While my employer thought I was extraordinarily diligent, the real reason was that my wife, Jane, was a newly qualified doctor doing

her housemanship at Groote Schuur, so she had to work all hours and I would get up early to take her in before going directly onto the factory. Then I would go back to collect her, sometimes at midnight. With this extra time, I was able to operate the plant for double shifts and increase production that was sadly behind, all with the help of a small dedicated staff who performed miracles,” Bewsey recalls.

Within two years he was promoted to general manager of the company’s larger plant in Alrode, Synchem, where he again set about revamping the process streams wherever he saw opportunities. “I spent two years there modernising the plant, which was originally designed by a chemist as a large scale up of laboratory equipment.

“While at Synchem I researched a method of milling one of the end products – phenothiazine – to below 3 microns, which would greatly reduce the cost of processing. The board was unwilling to invest in this new technology, however. Then I saw our fire-extinguishers being serviced and the powder poured out onto a plastic cloth to check if still inherent. The powder used in those days was sodium bicarbonate (NaHCO<sub>3</sub>), and I rushed off to the library and read up on making this powder.



“Using the milling technique, I made a wonderful batch of fire extinguisher powder, which I took to the board as a new product option in an attempt to justify the mill investment. They were horrified: A pharmaceutical company cannot make fire extinguisher powder, was the thinking.

“I shared my frustration with a friend, Glenn Howard, who supplied our packaging materials at that time and who suggested going into business together to make this powder. He went ahead and registered a company called Glenjohn Chemicals, which eventually grew to be an avant-garde chemical business,” he says.

“Initially, we battled to break into the market, but a company called Mine Safety backed us and, from then on, our market share quickly grew until we were manufacturing some 80% of the powder required by the South African market,” Bewsey tells *MechChem Africa*.

Seeking new opportunities for Glenjohn during this period, Bewsey placed a small advert in a British Chemical Engineering journal inviting people to submit development ideas. “One idea struck home and it was for the manufacture of synthetic tartaric acid. I went to London to meet a true eccentric – Dr Michael Arnold – who introduced me to a process that had never been commercialised before. At that time, Beechams was using some 3000 t/a of tartaric acid in its Eno’s Fruit Salts in South Africa.

“The initial trials in our pilot laboratory were a disaster. The first batch in the 5.0 l reactor failed to stabilise at the 70 °C expected and as the reaction is violently exothermic, the temperature quickly went over 100 °C. I rushed around the corner and chased everyone out of the office alongside the lab just before the vessel erupted, spreading our first batch all over the ceiling and drizzling down onto the admin desks,” he relates.

After developing a way of controlling the reaction, Glenjohn applied for government funding to set up a production plant. “We had to locate the plant in one of the so-called homelands, though, so we built a plant in the



*Agrofert Technologies’ factory where Bewsey began to manufacture nitrates before migrating to an organic granular product manufactured from reinforced chicken manure.*

Eastern Cape that employed some 100 people and became the first company in the world to make synthetic tartaric acid.

"We also made polyurethane through a partnership with Tebbe Polymers from Germany. The German operation went bust, though, leaving us owning the technology, which was eventually passed on to Industrial Urethanes, a significant supplier to this day," Bewsey says.

He goes on to tell the story of his search for a way to make peroxide. "I met a Swedish gentleman who had used Russian technology in Sweden to build a peroxide plant and we built a similar plant at Chloorkop, which used the hydrogen gas from KOP, now NCP. I have always found it amusing that I could get Russian technology via Sweden at the peak of apartheid when both countries were sworn enemies of South Africa," notes Bewsey.

"One day in our Chloorkop factory I saw a delivery vehicle loaded with magnesium nitrate labelled 'made in Haifa, Israel' and, with amazement, I realised that this valuable fertiliser was not manufactured in South Africa at all."

Through a company called Agrofert Technologies, Bewsey entered the fertiliser industry, first via nitrates but the company quickly migrated towards manufacturing a host of other fertiliser raw materials. "We were early adopters of the organic route with a granular product manufactured from reinforced chicken manure and ended up as the seventh largest local fertiliser supplier in SA," he recalls.

Having become increasingly aware of contaminated water problems, John Bewsey began to explore water treatment and waste recovery issues, more specifically, using his fertiliser experience to convert dissolved salts in wastewater into high-value fertilisers. This work resulted in the establishment of a new company called Trailblazer Technologies in 2006.

Explaining the problem with inorganically polluted water, he says that sodium is one of the worst water pollutants. "When AMD is treated with lime, for example, the heavy metals are removed and the treated water emerges neither brown from the iron nor green from the chromium. So it appears to be safe. This is not the case, however. It still contains very high concentrations of sodium and other salts. The sodium salts are particularly hazardous, as is evident when seawater is used on arable land. It quickly causes the clay particles to absorb the sodium ions, which makes the soil impermeable. This causes the flora and the soil beneath it to die," he notes.

He adds that more than 200 ppm of sodium in water is seriously damaging to agriculture and 63% of all river waters are used for irrigation. "Lots of our treated industrial mine



Trailblazer Technologies' recovery-based water treatment process uses a battery of continuously stirred tank reactors (CSTRs) and operates continuously and counter-current to produce demineralised water, with the contaminants being absorbed onto the ion-exchange resins for recovery upstream.

water is running into our rivers at 800 to 1 000 ppm of dissolved sodium," he points out.

Bewsey has filed several award-winning patents, including the net-profitable KNeW, ZIX-Zak and No-Briner processes for treating all types of high salinity wastewater, while recovering the salts to manufacture potassium nitrate ( $\text{KNO}_3$ ) and ammonium sulphate ( $(\text{NH}_4)_2\text{SO}_4$ ).

Summarising the process, he says that Trailblazer Technologies' recovery-based water treatment process starts after lime treatment in the case of AMD and underground saline water, and organic sewage treatment in the case of sewage. His process targets the removal of dissolved inorganics down to the level of potable water.

A battery of continuously stirred tank reactors (CSTRs) operates continuously and counter-current. This process produces demineralised water, with the contaminants being absorbed onto ion-exchange resins.

"The resins are then regenerated, using nitric acid for the catex resins to replace the cations with the  $\text{H}^+$  ion; and ammonia to place an  $\text{OH}^-$  ion onto the anion exchange resin. The resulting product is a nitrate blend that is treated with sodium carbonate to cause all the multicharged cations to precipitate, enabling the precipitate to be filtered off and dried for use as a soil ameliorant.

"The residual sodium nitrate solution is then mixed with an equimolar amount of potassium chloride and evaporated, with the result that the least soluble salt, sodium chloride, which has an absolutely flat solubil-



John Bewsey (centre) receives the 2013 IChemE Water Management and Supply award for innovation and excellence.

ity curve, crystallises out for easy separation. This allows the residual liquor to be cooled to produce a pure crystalline potassium nitrate ( $\text{KNO}_3$ ), which is dried for supply to horticulture as a primary and valuable fertiliser with global demand," Bewsey explains.

An elegant solution that fits neatly into the ideas associated with the circular economy.

The sale of the nitrate-based fertilisers reduces the costs of treating wastewater to zero. In addition, there is the environmental advantage of reducing the amount of waste having to be dumped to an absolute minimum. "It is possible to make the process profitable, even after amortisation deductions," he predicts.

A SAICHe IChemE member since the early 1970s and an Honorary Fellow since 1978, John Bewsey uses his experiences to inspire young engineers to appreciate the diversity offered by the chemical engineering profession.

"Many shy away from chemistry, but for those who love it, the opportunities are endless," he concludes. □

# Local implementation of global best-practice training model

SKF and its subsidiary, Lincoln Lubricants, are currently expanding and broadening their training programmes in preparation for a 2020 move into new premises in Jet Park. *MechChem Africa* talks to global Centre of Excellence manager for SKF Training Solutions, David Reed, and Gail Taylor, sub-Saharan Africa's SKF training solutions business development manager.

SKF began to offer training services in South Africa in 2009 when the new SKF Solution Factory was established. "Training is not new to us, but we are on a continuous improvement drive. When we move into our new premises next year and are fully integrated with Lincoln Lubricants, we will be able to jointly offer an extended and comprehensive range of courses," begins Gail Taylor, SKF's training solutions business development manager for sub-Saharan Africa.

"Many people are not aware of the world-class training courses SKF offers for local industry, from bearing installation and lubrication courses all the way through to vibration analysis and the recently-added fundamentals of condition monitoring courses," she adds.

"Globally, we strive to help customers understand the basics of their own machinery," continues David Reed, who heads up the SKF Global Centre of Excellence for SKF Training Solutions. "The entry-level introduction to condition monitoring course, for example, is

ideal for those who do not have any experience in the discipline, which is now an important vehicle for improving equipment life and reliability. This course presents the background knowledge necessary before getting into the practical detail of the different analysis technologies used to keep track of equipment conditions," he adds.

Reed says that SKF has developed a range of different training programmes to help people get the best possible value from their rotating equipment. "First, bearings and seals need to be properly installed in rotating equipment; but lubrication, maintenance and instrumentation products are also needed to keep installed bearings and seals healthy and to protect against damage and unscheduled breakdowns.

"SKF offers hand-held monitors and online systems that enable us to tap into and continuously monitor the condition of rotating machines in operation. By monitoring the

health of installed bearings, a host of other problems can be picked up: misalignment and imbalance issues; looseness of bolts; under or over lubrication; as well as overloading or overspeed in operation," he explains.

In addition to teaching operators about how to monitor and analyse a bearing's condition, SKF courses advise on how to apply instrumentation to best suit particular applications. "Pumps, fans and compressors are all different, for example. We have application and industry specific courses to help people look after the specific machines they employ," Reed continues.

Also offered are maintenance consultancy services for individual customer sites. "Failure modes, affects analysis and spare parts optimisation can help to minimise breakdown risks and maximise reliability. These services can be performed by SKF staff, but ideally, we can train maintenance managers to continuously seek optimisation opportunities. SKF is always willing to adapt its global services to suit local needs because we understand that every site is different and that capability and expertise vary considerably," he tells *MechChem Africa*.

Site or plant specific courses will often start with a training needs analysis to determine the broad level of available skills and to identify gaps. "We typically use a customised self-assessment we have developed using questions from our benchmarked global database. Relevant questions that relate to the equipment onsite are chosen and the responses compared to previously recorded similar experiences. We can then quickly establish a best fit training programme that we know has led to success in the past," Reed explains, adding that a skills auditing specialists can also talk to site personnel to collect this data.

"Our service goes beyond training and into mentoring and coaching after the train-



For training, SKF uses its own engineers who have real experience, so transfer knowledge is made more concrete.

ing has ended. This helps plant managers to get the very best end results from training investments. Following a bearing installation course, for example, one of our applications engineers can oversee the first few bearing replacements on the site to make sure that the learning is being applied correctly," he says.

In preparation for its 2020 move into new premises in Jet Park, SKF South Africa is currently developing a new training centre facility. "With a similar footprint, our new premises will have significantly higher warehouse stacking space and more office space. The training facility will include Lincoln Lubricants' courses, which will create an opportunity to significantly expand and modernise," says Taylor. "Integration with Lincoln Lubricants brings a heavy emphasis on the practical side of training with respect to bearing care and lubrication," she adds.

"We are facing a skills deficit in South Africa, but at the same time localisation initiatives demand that we stop importing skills. With these new premises, we are demonstrating our long-term commitment to localisation and skills training, which are fundamental to SKF's global offering.

"When installing a bearings installation procedures are needed to keep contamination out, while proper lubrication is essential to ensure the bearing survives. For training we use our own engineers who have real experience, rather than theoretical lecturers. By sharing their experiences of how real and unexpected situations were dealt with, knowledge transfer is made more concrete and permanent," Taylor suggests.

"Globally, SKF has always done training this way, the idea being to ensure that every course is 100% real and relevant. We have always relied on our own experienced subject matter experts.

"This is also true for vibration analysis and condition monitoring courses, where we will often take trainees onto a site to do the monitoring before bringing the data back for analysis. This approach creates knowledge and experience at the same time," adds Reed.

SKF training, he says, is not specific to SKF products. "A vibration monitoring course, for example, deals with how to use any vibration monitoring solution to best effect, enabling candidates to use any instrument brand to track the health of any bearing brand," he assures. "We strive to pass on the skills to collect information and to do a machine health analysis and neither the equipment used nor the bearings installed need be from SKF for this to be usefully applied on the plants where technicians are employed," he adds.

"In addition, because we used skilled engineers to do the training, if customers need a plant-specific maintenance course, we can accommodate them – and we regularly go



*Bearings and seals need to be properly installed in rotating equipment, but lubrication, maintenance and instrumentation products are also needed to keep installed bearings and seals healthy.*



*The new training facility will include Lincoln Lubricants' courses, which will create an opportunity to significantly expand and modernise.*

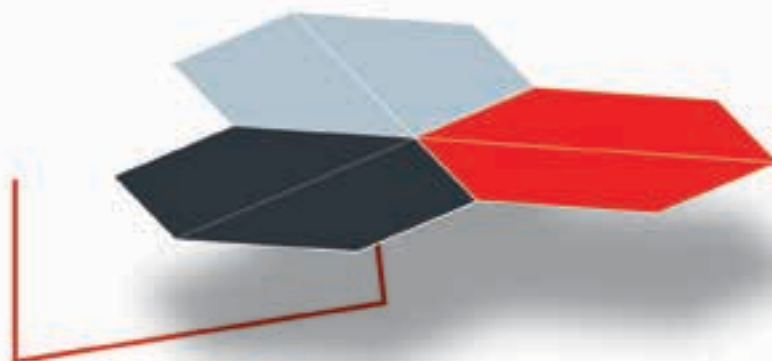
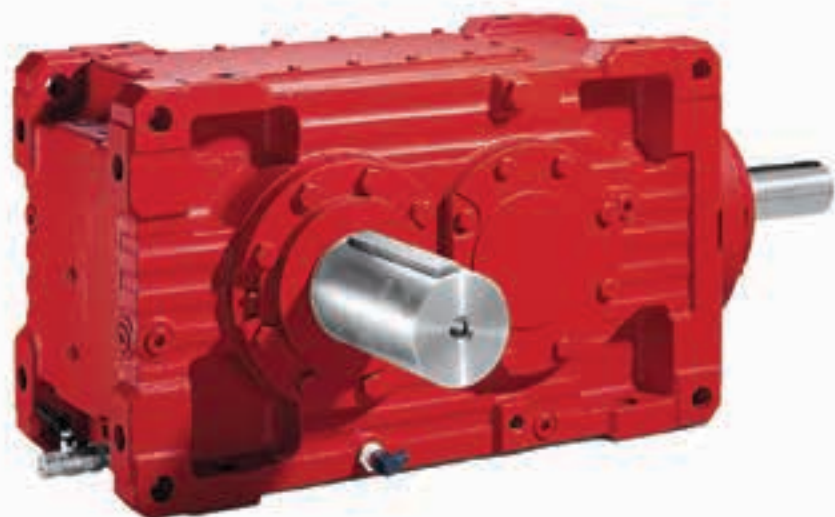
across the border to do these courses, to Zimbabwe, Zambia, Kenya or anywhere in sub-Saharan Africa," continues Taylor. "SKF South Africa has been chosen as the training hub for Southern Africa and, as well as customer training, we take responsibility for training internal SKF employees from across the region. All junior engineers and customer service personnel can benefit from ongoing upskilling initiatives," she adds.

David Reed, who studied materials engineering before gathering 22 years of experience in reliability and total productive maintenance (TPM) programmes on customer sites, says that core course materials are developed by a network of SKF professionals, who are encouraged to make the content as modern and usable as possible. "Every course is vetted by our global Centre of Excellence and, here

in South Africa, we have course accreditation from the British Institute for NDT (BINDT) and from the Southern African Institute of Mechanical Engineers (SAIMEchE).

"SKF is dedicated to helping customers improve the performance of their rotating equipment. To even begin to achieve this, the equipment must be installed correctly, lubricated and maintained correctly. We must also be ready to learn from failures that may occur, via root cause failure analyses, for example.

"Using training to enable operators to better understand these needs, it becomes possible to continuously improve rotating equipment performance while maximising plant productivity and minimising the total cost of ownership of our customers' assets," Reed concludes. □



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# Improved design and efficiency tips balance towards replacing HV motors

The applications knowledge of Zest WEG Group, coupled with the design capability of parent company WEG, now make it easier than ever for old high voltage (HV) motors to be replaced with new, improved HV machines within the customer's existing footprint and operational configuration.

Compared to high voltage (HV) motors designed 20 to 30 years ago, advances in technology allow HV units to be made smaller than the originals, says David Spohr, Zest WEG Group's newly appointed business development executive who works with customers to optimise their HV motor operations.

WEG's HV motors are typically purpose-built to meet the precise needs of the customer. While smaller in dimension compared to the original older HV motors, these motors still deliver the required performance at even higher output and efficiencies.

"As a leading technology provider of a wide range of motor products, we have the capability to design a replacement motor to match the footprint of the original unit," Spohr says. "This means it is not necessary for customers to modify mechanical infrastructure or electrical design to accommodate an upgraded motor."

He notes that, with the design lifespan of electric motors ranging between 20 to 30 years, there are still many old units in operation around South Africa. Technological improvements in motor design and efficiency, however, present a compelling case for the replacement of old units rather than repeated repairs.

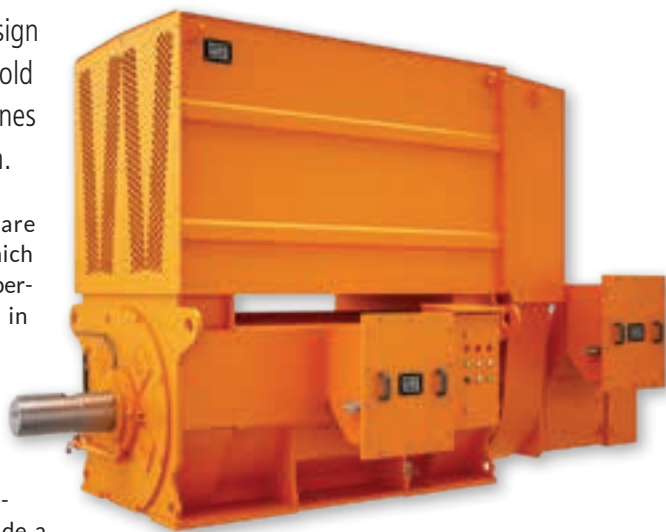
Spohr highlights that the cost of a major motor overhaul could be up to 60% of the cost of replacement. The advanced technology of the new units, however, brings important

benefits. Key among these are reliability and efficiency, which means improved operational performance and direct savings in energy consumption

"When motor failures occur, Zest WEG Group has the ability to conduct a detailed on-site analysis," Spohr says. "Based on a root-cause analysis, we can provide a failure assessment, which will enable the customer to make an informed decision."

The assessment includes an energy consumption analysis conducted with specialised software. In the light of the machine's application, Zest WEG Group recommends enhancements for greater control and efficiency. These include motor control options such as variable speed drives (VSD) for applications such as fans and pumps.

"There are also significant productivity benefits from a new, more reliable motor," says Spohr. "Unplanned downtime can severely erode plant performance, reduce output and put supply relationships with customers at risk. All this needs to be considered in the decision to continue repairing old motors," he concludes. □



WEG M Mining Line three phase HV induction motor specially developed to be robust.



WEG W60 three-phase HV induction motors ensure high performance and reliability.



A high voltage mill drive motor in operation at a mine in South Africa.



A WEG-wound rotor induction motor installed on site.



BI Durban branch manager, Trevor Veeradu, who is also the company's regional manager for KZN.

# KZN is a key growth area for BI

The Bearings International (BI) Durban branch stocks bearings, electric motors, gearboxes, lubricants, seals, tools and power transmission products for a range of industries. These include food and beverage, cement and quarries, pulp and paper, port and rail, water and sanitation, sugar mills, mining, petrochemicals, and animal-feed plants.



Bauer gear motors available from BI have a strong foothold within the food and beverage, alternative energies, wastewater, steel industry and materials handling sectors. Latest products include Bauer premium efficiency gear motors that enable energy savings of over 30% and, if needed, come with ATEX approval for use in explosion hazard areas.

**A** distributor of premium global brands such as FAG bearings, FIS products, INA, Bauer electric motors and gearboxes, Rocol Lubricants, Cooper split bearings, Senqcia (Hitachi) chain, Ewart Chain, KOYO, Link belt, Dodge, Rexnord, Makita power tools, and Jonnesway professional tools, BI's Durban branch is strategically located at 11 Palmfield Road in Springfield Park, just 25 km south of King Shaka International Airport.

The branch employs ten staff specialising in an array of industries. Nick Allanson, for example, heads up the specialised sugar division for BI, focused on servicing Illovo and Tongaat Hulett throughout Africa with world-class products and services.

The branch is managed by Trevor Veeradu, who is also KZN region manager

and has 15 years of industry experience, starting his industrial engineering degree in 2000 as an instrument fitter at Sappi, and then progressing to sales in the bearing industry at BI.

Veeradu's engineering expertise has stood him in good stead with regard to industrial gearboxes and conveying systems, specialising in light and heavy duty rubber belting, and thereafter hydraulics and pneumatics.

BI Durban offers support to the entire KZN province, as well as supplying customised solutions for largescale technical projects. "I drive my team to be self-assured and knowledgeable and, most importantly, to add value to our vast customer base, which is my key focus," Veeradu stresses.

The Durban branch has an in-house division that refurbishes



BI stocks all major types of industrial chain for use in Southern Africa's sugar, cement, steel, agriculture and mining segments. Key brands include Senqcia (Hitachi) chain, Ewart Chain, KOYO, Link belt, Dodge and Rexnord.



BI has a long history of distributing Rocol lubricants, which can significantly reduce the power consumption of rotating equipment while extending component life and reducing downtime.

sugar mill carrier and diffuser chains, as well as assembling and supplying new chain. It also manufactures specialised sprockets as per customer requirements.

Additional services encompass bearing inspections and fitments, condition monitoring, customer training, gearbox repairs, technical advice for all projects, from small to large, as well as bearing reconditioning, vibration analysis, specialist manufacture, on-site operations, troubleshooting, 24/7 service, and even design and selection.

Staff are kept up to date by means of ongoing training, which is also offered to customers upon request. "Through our product training courses, we strive to ensure that our customers have optimal understanding of product handling, fitment, and maintenance. In this way, customers are sure to obtain the highest return on their investment," Veeradu points out.

There are six BI branches that service KwaZulu-Natal, including Durban. These are Richards Bay, which is managed by Grant Fouche, Isithebe, Pinetown, Pietermaritzburg and Newcastle. Veeradu says that this is proof that KZN remains a key province to the company as a whole and an important growth area. "BI in KZN strives to offer its customers top-quality products, with the best customer service, which makes for loyal and satisfied customers.

"Our strength lies in our people, their knowledge and their commitment to servicing customers who have supported us over the last 65 years. We have great plans to extend our product offering even further in the future. As part of the Hudaco Group, our value proposition to our customers is also commensurately larger," Veeradu concludes. □

## VDrivePlus and AlphaDrive-Micro VSDs from BI

BI leverages synergies across a broad range of companies to offer a complete product basket from its extensive branch network. One of these areas is electronic motor control solutions from Hudaco Group company, Varispeed, which has just launched the VDrivePlus and AlphaDrive-Micro VSDs.

“For BI, it is all about the breadth of our product offering, which extends far beyond our customers’ core focus. This is because we look at customer requirements holistically. It is also a great way to introduce our customer base to the larger Hudaco Group,” says BI marketing manager, Victor Strobel.

The AlphaDrive-Micro VSD from Varispeed is a compact frequency inverter ranging from 0.2 to 5.5 kW, and available in 240 and 400 V. Together with the VDrivePlus, these VSDs offer the best performance-to-cost ratio on the market, without compromising on quality and reliability. “Due to the current economic environment, the market is very price-sensitive. Therefore, any energy-efficiencies or cost-savings we are able to offer are hugely beneficial,” Strobel notes.

Certified in accordance with the latest European standards and regulations, the

AlphaDrive-Micro is ideal for lower-power applications in most sectors of the South African market, including mining, food and beverage, manufacturing, and agriculture.

The compact design of the AlphaDrive-Micro VSD means it is easy to integrate into an electrical panel, as it mounts directly onto a DIN rail. A built-in software menu caters for optimised parameters for applications such as fans, belts, conveyors, and pumps. Applications range from mining plants to water reticulation, HVAC, food and beverage, canning and bottling plants.

The AlphaDrive-Micro VSD is based on the MODBUS protocol for open networking, with an EMC filter as standard. An innovative feature of both of the drives is a parameter copy stick that allows for an automatic back-up of parameter settings in the event of load shedding. It also means that the same set of parameters can be transferred to multiple drives on different sites.

The VDrivePlus from Varispeed is a much larger drive, ranging from 0.4 to 400 kW and available in 240 and 400 V versions. This more advanced VSD features advanced motor control based on DSP technology, together with ‘smart’ auto-tuning. Additional



The Varispeed AlphaDrive-Micro VSD from BI is a compact frequency inverter.

features include flexible inverter control, dual high-resolution analogue inputs and free mappable I/O channels.

A universal function set is available for a range of industrial and residential applications, including integrated PID/pump controller routines. ‘Smart’ PC tools allow for quick inverter control, parametrisation, and troubleshooting.

Strobel points out that the VSDs can be easily supplemented with the Bauer electric motor range from BI. □

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# Advanced geared drives for leaner times

MechChem Africa visits the Aero-ton premises of SEW-EURODRIVE in Johannesburg and talks to South African MD, Raymond Obermeyer, about latest advances in drive technology and the local company's plans to be the assembly, supply, refurbishment and training hub for Africa.

“The main focus of Hannover Messe 2019 earlier this year was on automation and Industry 4.0 and SEW-EURODRIVE participated with a heavy focus on its automation solutions for the automotive manufacturing industry. In addition, though, we launched a host of product facelifts on the power transmission side, which we are very excited about.

“Local industry needs a bit of good news and several improvements we have made to our industrial gear unit range means that existing units can now be replaced with smaller, less costly, units that meet performance specifications better than ever,” Obermeyer begins.

He cites several products improvements incorporated into SEW-EURODRIVE's Generation X.e series helical and bevel helical industrial gear (IG) units.

- Contactless sealing systems: which neither cause nor are affected by wear at the input and output shaft. “The risk of loss of oil due to a seal failure is significantly reduced and operational safety is increased,” he says, adding that this results in significantly longer maintenance intervals for the drive system.
- Thermally improved oil level: “There is a fine line between a reduced oil limit and optimal heat dissipation. Knowledge of how these interact has enabled us to optimally reduce the oil bath temperature, which results in increased operational safety, savings on resources and prolonged oil change intervals,” Obermeyer tells

MechChem Africa, before reporting oil volume savings of up to 29%; increased oil service life by up to 110%; reduced churning losses by up to 87.5%; reduced oil bath temperatures by up to 8%; and an increased thermal limit rating of up to 32%.

- Optimised bearing preload: Establishing ideal bearing preload settings during assembly reduces the formation of heat spots, resulting in reduced compression and significantly increased bearing service life: by up to 220%. In addition, the bearing's thermal limit rating can be increased by up to 24% and the oil bath temperature reduced by up to 4%.
- Optimised gearing topology: The optimised tooth flank topology minimises displacement tendencies, enabling the unit to better tolerate meshing interference. This helps avoid downtime and increases system availability. These improvements allow for increased static overhung loads by up to 41% to accommodate unfavourable application angles. This gives higher operational safety of the drive when external forces effect the shafts and lower gear unit noise due to optimised tooth meshing.
- An improved bevel pinion housing enables optimised oil flow. This is the basis for the higher thermal rating and results in higher operational safety. Higher powers can also be transmitted without the risk of failure. Reported improvements include: a 30% reduction in system power loss; increased operational reliability and improved cold-



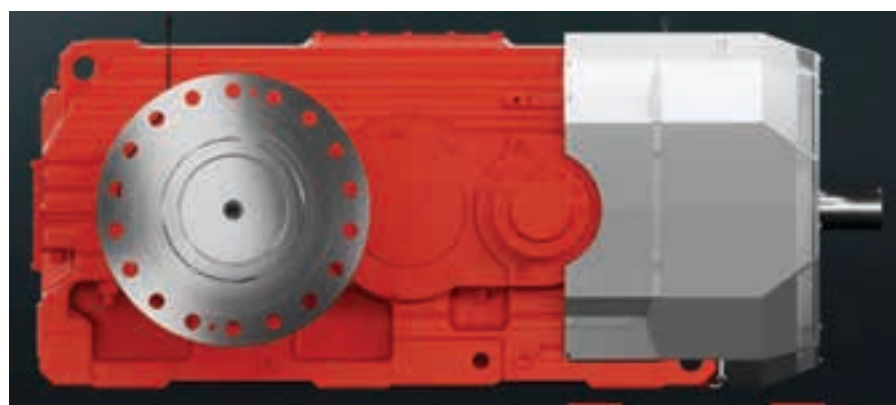
start behaviour; and increased overall limit rating – by up to 153%.

- Universal fan guard: The concept of SEW-EURODRIVE's universal fan guard is to allow various fan sizes (boost, balanced and silent) and fan types to be arranged under one cover. Not only does this enable the installation dimensions in a system to be standardised, it also allows for an optimal cooling, while enabling specified sound pressure limits to be met. This innovation reduces the oil bath temperature by up to 36%; increases thermal limit rating as compared to axial fan technology by up to 54%; and lowers the sound pressure by up to 7.0 dB(A).

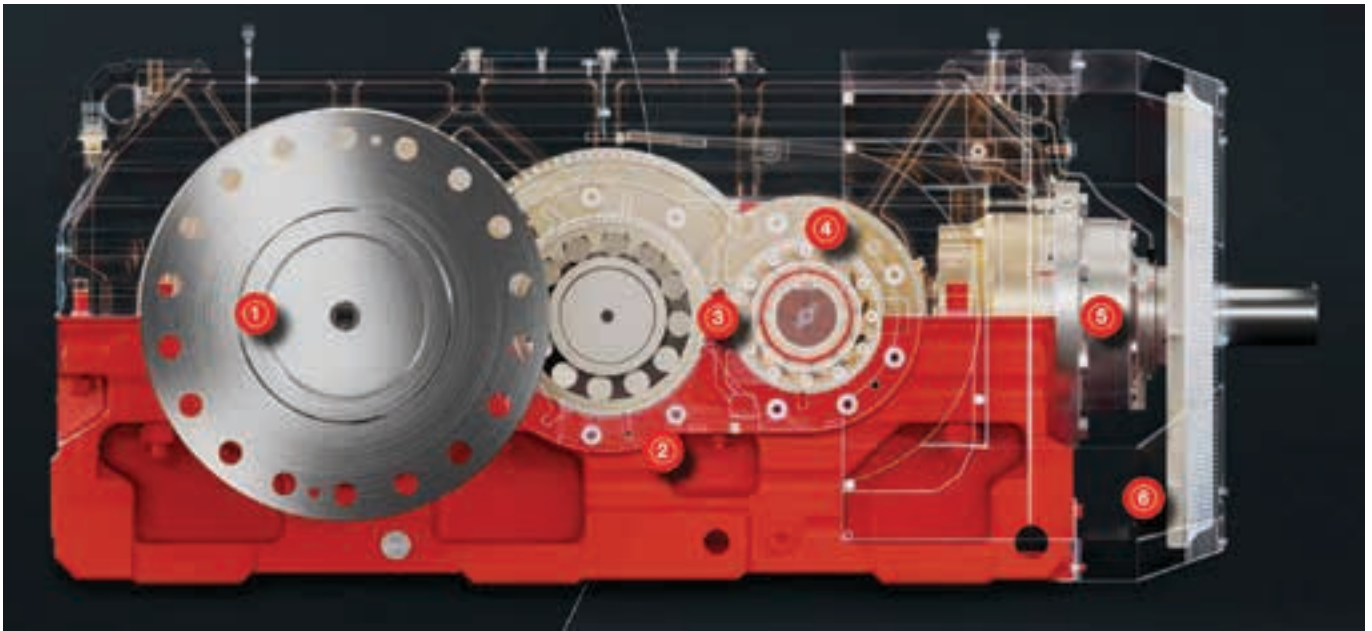
“Combined, these improvements enable downsizing of Generation X.e IG units compared to competing technologies and installed units due for replacement,” Obermeyer argues. This not only makes for much better reliability and substantially lower total costs of ownership, but the capital expense of smaller more efficient units can substantially lower capital infrastructure costs compared to systems dependent on larger previous generation gear units.

As part of the design revamp of the Generation X.e range, the number of separate assembly parts, part sizes and functions has also been reduced. “This is good news, too, especially in these difficult times. Stocking levels and total assembly times can be reduced, which enables us to respond more quickly to ordinary and emergency orders,” Obermeyer says.

“When other gear unit manufacturers are closing down, these constant improvements are enabling SEW-EURODRIVE to meet new people and expand into new markets,” he continues, citing particular successes in the sugar industry with the SEW-EURODRIVE planetary range. “These units are ideal for diffusers in the sugar industry, for example, and we have added the P-X series of planetary combos to our sugar range, which consist of two industrial gear units in one solution for meeting demands in the sugar industry,” he notes.



SEW-EURODRIVE products improvements include Generation X.e series helical and bevel helical industrial gear (IG) units.



SEW-EURODRIVE's Generation X.e Industrial gearboxes set new benchmarks in six areas. 1: Contactless sealing systems; 2: Thermally improved oil levels; 3: Optimised bearing preloads; 4: Optimised gearing topologies; 5: Improved bevel pinion housings; 6: Universal fan guards.

The P-X series combines compact planetary drives with robust bevel helical industrial gear units. Thanks to excellent performance and high operational reliability, these units are an ideal solution for drives in the medium to high torque range, particularly in demanding environments such as sugar mills. "Combo units deliver an optimum power to weight ratio and an improved thermal limit rating through the use of a shared oil chamber," Obermeyer explains.

P-X series advantages include: more flexible plant and machine optimisation with respect to efficiency, throughput and costs; substantial savings in time and costs from engineering through to startup thanks to the compact drive size; the modular industrial gear unit package; single sourcing of the different drive types; and maximum plant availability thanks to rapid on-site assistance via a comprehensive network of service support.

"We can now also attach our own motors to these drive packages and, while we are not well known for our combos or our motors, we are picking up a lot of new business in these areas," Obermeyer tells *MechChem Africa*.

While new projects remain scarce in the current economic climate, SEW-EURODRIVE is picking up significant amounts of repair and refurbishment work. "We have developed a good reputation for drop-in boxes, which enable us to replace legacy gearboxes from any of the commonly used

*The weight-optimised design of SEW-EURODRIVE's P-X combo boxes opens up new opportunities for machine optimisation in terms of throughput, costs and operational safety.*

OEMs in South Africa with modern SEW technology. We design and manufacture a conversion-plate that matches the existing structure, but allows our gearbox to be mounted and connected to the existing drive train – and these drop-ins are now also available for planetary and P-X combo boxes," says Obermeyer.

With respect to the expansion of its local facilities in South Africa, Obermeyer cites three ongoing initiatives: the move into new premises in Port Elizabeth to better service the automotive industry; the expansion of the Nelspruit facility into a dedicated gearbox refurbishing facility; and building a new assembly facility in Johannesburg.

"We have recently heard from our German parent that we will be building a new state-of-the-art, Industry 4.0 assembly facility here in Aeroton, Johannesburg. This will be our African flagship for the local design, production and assembly of new standard units, customisations and custom designed drive train projects. This factory will be a rapid turnaround high-volume facility for servicing the whole of sub-Saharan Africa," he reveals.

"Nelspruit, which currently assembles large industrial gearboxes, will be re-equipped as our centre-of-excellence for refurbishments and we intend to extend this offering to any brand of box," he continues, adding that SEW-EURODRIVE's new Nelspruit facility will be able to rebuild between 150 and 350 industrial gear units per year, all to original-manufacturer specifications.

"We are a company that prefers to uplift our people from the inside, training and promoting our own staff into management positions and upskilling our shop floor workers to enable them to take on increasingly technical roles. We believe in the long-term, so we create our own family of skilled and loyal staff who might stay and grow with us.

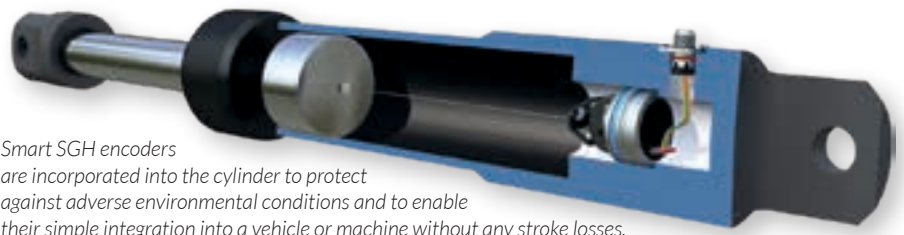
"In spite of current challenges and with direct support from our mother ship, we have been able to make decisions quickly and remain on a steady growth path – and I am confident that we will again meet the growth commitments we made in November 2018," Obermeyer concludes. □

# Position sensor detection for hydraulic cylinders: a world first

SIKO's SGH wire-actuated encoders from INSTROTECH can now be used to measure the stroke and speed in hydraulic cylinders with impressive efficiency, flexibility and robustness.

**S**IKO's SGH sensors use a wire draw mechanism integrated directly into a hydraulic cylinder to measure its stroke. The wire of the mechanism is secured to the piston head. When the cylinder extends, the wire wound on a wire drum is pulled out. The resulting rotation of the drum is detected by the contactless sensor system and converted into a linear position.

This enables precise and absolute position or speed tracking of the cylinder at any time. The magnets used to measure the rotation are scanned by a contactless sensor system through the pressure resistant base plate of the SGH sensors. The electronic components are fully encapsulated and located on the non-pressurised side of the system. The entire measuring system is therefore incorporated into the cylinder and optimally protected



Smart SGH encoders are incorporated into the cylinder to protect against adverse environmental conditions and to enable their simple integration into a vehicle or machine without any stroke losses.

against external environmental influences.

This offers a key advantage: in contrast to measuring systems mounted externally on the cylinder, the sensor system cannot be damaged, negatively affected or even destroyed by external events or environmental conditions.

Developed for the tough conditions in mobile hydraulic applications, SIKO SGH sensors were designed and developed in line with the strict specifications of renowned hydraulic cylinder manufacturers. Market demands ensured that SIKO met their requirements regarding robustness, durability and functionality. SIKO worked closely with cylinder manufacturers to define and satisfy the specifications regarding service life, shock and vibration resistance, EMC and

compatibility with various hydraulic media. All specifications were tested and confirmed in endurance tests at the facilities of cylinder manufacturers or in external accredited laboratories.

This SGH technology transforms hydraulic and telescopic cylinders as well as piston accumulators into smart cylinders and hydraulic systems – and suitable sensors are available for most applications. With measuring lengths of up to 5 000 mm, a wide selection of interfaces as well as high flexibility for integration of the sensors, the SGH family offers a comprehensive range of possibilities.

Smart sensors take mobile hydraulics to a new level of safety and efficiency. 'Functional safety' is a term that is being widely discussed. Safety concepts for mobile machinery has

## Rand-Air takes the stress out of mine shutdowns

Rand-Air Internal Sales Consultant, Adele Matthee, talks about her company's equipment hire offering for scheduled and unscheduled maintenance in the mining industry.

**W**ith the vast amounts of capital invested in them, the production pressures on major mines are immense and unscheduled production stoppages need to be avoided at all costs.

However, a mine's major plant installations such as compressor and metallurgical facilities, are pivotal to production. Breakdowns in these areas can be hugely expensive. Planned shutdowns provide a mine with the means to avoid unscheduled stoppages, as these allow for maintenance, repair and upgrading of plant and facilities, which, because they often work a 24/7 duty cycle, cannot be taken out of service during normal operation.

"The keys to a successful scheduled shutdown are meticulous planning and effective communication," says Rand-Air Internal Sales

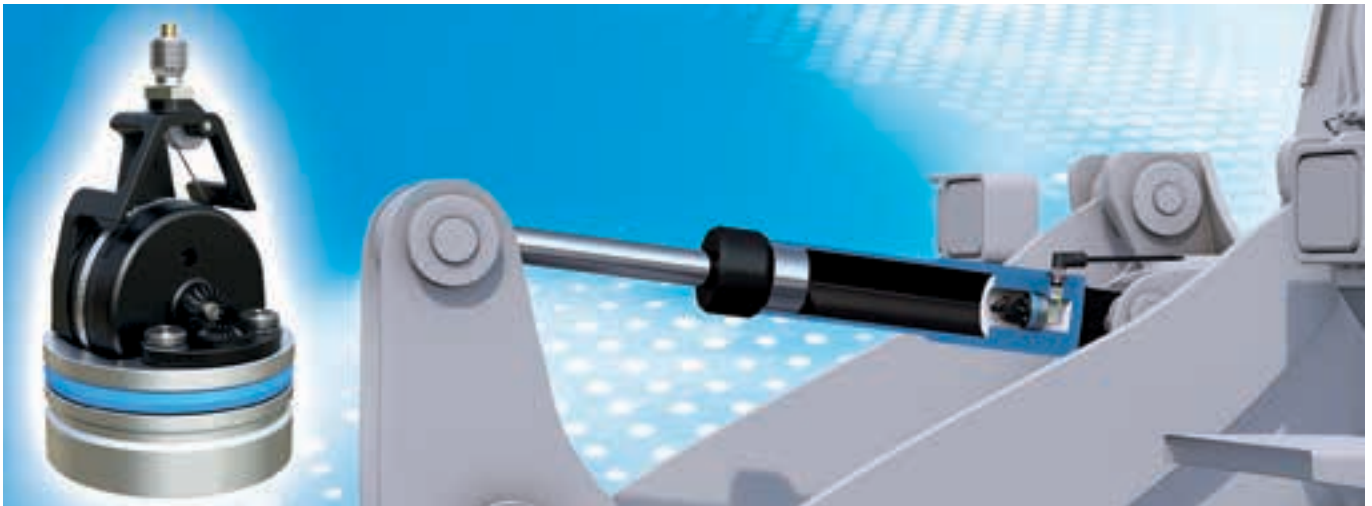
Consultant Adele Matthee. We have been involved in the planned shutdowns of many of our mining customers for years and have good knowledge of the type and quantity of hire equipment they will typically need," she says. Many of Rand-Air's mining customers have the foresight to start planning a shutdown months in advance. "This is immensely valuable for us at Rand-Air as we can plan to have all necessary equipment ready at the due date," she continues.

Often with planned shutdowns, specialist contractors are brought onto site to carry out specific contracts. However, to avoid the unwieldy situation of contractors hiring and rehiring equipment, mines prefer to place a single order for hire equipment, which they then put at the disposal of the contractors concerned.

Having really good knowledge of a



mine's operations is valuable when preparing for a shutdown, explains Matthee. One needs to know practicalities such as how hire machinery will connect to a mine's reticulation systems or whether a mine will be



SIKO's wire-actuated position tracking system for telescopic cylinders is a world first.

been a topic of interest since the implementation of the new Machinery Directive EN 13849. Sensors in the SIKO SGH range help implement intelligent safety concepts for mobile machinery and meet the requirements of the specific safety standards for different utility vehicles.

The safety versions of the SGH25 and SGH50 sensors meet the requirements for use in applications up to Performance Level d (PLd). Safe and redundant design in compliance with CAT3 as well as their safe mechanical design mean SIKO products are ideal for use in safety-critical applications and unusual conditions.

In addition, the sensors can stream process data, which not only serves to satisfy safety requirements, but also offers added value from the machine. The process data can provide insight into an impending seal maintenance interval, for example; flexible support tracking in crane and lifting applications extend the working ranges; and memory functions in industrial trucks save time and make for safer working conditions. All these are examples of how SGH sensors not only make machinery safer, but also more efficient.

Advantages of the SGH encoders include:

- Absolute detection of the cylinder position.
- Direct integration into the cylinder.

- A stroke range of up to 5 000 mm.
- They can be used in safety applications up to PLd.
- No drilling of the piston is required.
- They can also be used in telescopic cylinders.
- They have a protection category IP69K rating.
- A durable and robust design: they are developed in line with mobile hydraulic requirements.
- High EMC.

SIKO's SGH wire-actuated encoders for position detection in hydraulic cylinders are available in South Africa from INSTROTECH. □

able to use electric machines or not.

Rand-Air has a long-standing reputation for supplying high-performance, reliable equipment. Also, with both planned and unplanned shutdowns, the volumes of air that a mine requires can exceed what Rand-Air can supply from its own fleet. However, Rand-Air has other trusted suppliers from whom it can hire additional compressors to make up the volume required.

Once the necessary hire equipment has been sourced, the next challenge is to transport it to the mine, often from various distant locations. "Here, once again, we have years of experience of working with trusted logistics companies we know will deliver safely and on time."

Should a mine hire a significant number of machines, Rand-Air can often place a full-time technician on site as well as a containerised mini-depot stocked with all the spares that the technician is likely to need. Shutdown projects usually work around the clock to ensure rapid completion. When this is the case, Rand-Air ensures that technical support is also available on a 24-hour basis.

When Rand-Air receives an unplanned shutdown call, Matthee immediately con-

sults with Rand-Air's logistics section to establish what equipment is available within the company. "We have a computerised system operating throughout Rand-Air which we call our 'fleet board', which tracks the bookings and the availability of all our equipment. This is essential as we do not want to be taking a compressor, for example, from one of our depots for one hire when it has been booked for another," she says.

If Rand-Air does not have the fleet available at that specific time, Matthee and her colleagues know suppliers from whom they can cross-hire reliable, quality equipment. In this instance, Rand-Air takes on the role of the project manager. "For our customers, it means they can make one phone call and know that, for a shutdown, they can source all their hire equipment from one reliable supplier," she says.

Over time, the role of project consultant is one that Rand Air is increasingly taking on. Matthee explains that Rand-Air has developed a system that allows everyone involved, from the supplier and the customer,

to be fully apprised of exactly what is happening at any given time. If, for example, a compressor is being sourced from a distant site, the customer will know when the truck has been dispatched to fetch it, when the compressor is being loaded, when the truck is once again on the road and what the estimated time of arrival is. "This affords customers peace of mind so they can concentrate on their core activities," she says.

"For us at Rand-Air, mine shutdowns, while they are challenging, are also very exciting as they give us the opportunity to show what our company is capable of," says Matthee.

"The achievement of finding 50 000 cfm of compressed air for a customer at short notice and getting it safely to site on time is a satisfying and rewarding experience both for ourselves and, ultimately, for our customers," she concludes. □

**Should a mine hire a significant number of machines, Rand-Air can often place a full-time technician on site as well as a containerised mini-depot stocked with all the spares that the technician is likely to need.**

# Smart cities depend on adoption of 4IR

Taru Madangombe, vice president of Power Systems in the Anglophone Cluster for Schneider Electric, talks about the Fourth Industrial Revolution (4IR) technologies likely to drive the direction of the world's future smart buildings, infrastructure and cities.

“If you are not digital it will be very difficult to be competitive in industry, or in the buildings you produce. Because what you are building is here for the next 50 years, and it has to be green, smart and automated.” This is the opinion of Taru Madangombe of Schneider Electric, who notes that cities are a complex web of interconnected systems that each face their own challenges.

Schneider Electric has taken the lead in developing systems and solutions around Smart Cities over the past decade and is excited to see the concept being more broadly embraced by the industry. “As the World Economic Forum on Africa met in Cape Town in September for its 28<sup>th</sup> meeting, it was significant that the theme was ‘Shaping inclusive growth and shared futures in the Fourth Industrial Revolution (4IR).’

Today's cities cover only 2% of the planet's surface but hold 50% of the world's population. They also generate 80% of the global CO<sub>2</sub> emissions and consume 75% of the energy. In South Africa, urbanisation is also advanc-

ing at this pace and its city planners have to accept that extremely rapid growth is inevitable. This brings added pressure to the supply of energy, waste-disposal, transportation and other services,” he says.

## Future 4IR opportunities

“The key technologies powering Industry 4.0 (4IR) – artificial intelligence (AI); augmented/virtual reality (AR & VR); and the internet of things (IoT) – are reshaping business processes, unlocking opportunities and encouraging new business partnerships.

“A rich ecosystem of tools, organisations and experts is paving the way to a healthier workplace, more efficient businesses and a greener planet. Making the most of these new technologies requires openness, agility, collaboration and a clear understanding of the benefits that digital transformation will bring.

At present, those in charge of running cities, particularly at the operational level, are too focused on reducing costs, rather than on improving quality of life or service. “We need



to widen our vision, and see the potential of smart cities built on the latest technologies,” Madangombe continues.

“As urbanisation increases, cities and suburbs will undergo significant transformations to create sustainable living conditions for their residents. Energy and mobility are the twin pillars of these transformations and both will require radical adaptation to meet the demographic and economic growth, without increasing congestion and pollution.

“The question is whether policymakers and business leaders can harness and combine them in ways that maximise benefits for the environment and create greater efficiency and economic growth. The 4IR offers an unprecedented opportunity to do so,” believes Madangombe.

## Mobility in African cities

“Africa is urbanising faster than any other continent, at a rate of 4% every year, compared to the global average of 2%. The continent's rapidly growing urban population continues to strain transport and energy infrastructure. Electric vehicles (EV) can materially change this landscape through ride and car sharing, concepts that could reduce congestion in rapidly growing African cities.

“South Africa is hosting the Electric Vehicle Road Trip Africa (EVRT Africa) for the first time in October 2019, an indication of the interest that EV is generating. As EVs become more affordable, some are predicting they will constitute almost a third of new-car sales by the end of the next decade. Ride shar-



*With the coming of the IoT, digital integration of power distribution systems is not a choice, but a necessity. To harness the power of these disruptive technologies to improve operations and increase business value, one needs to explore opportunities offered by systems such as Schneider's IoT-enabled EcoStruxure Power architecture and platform.*

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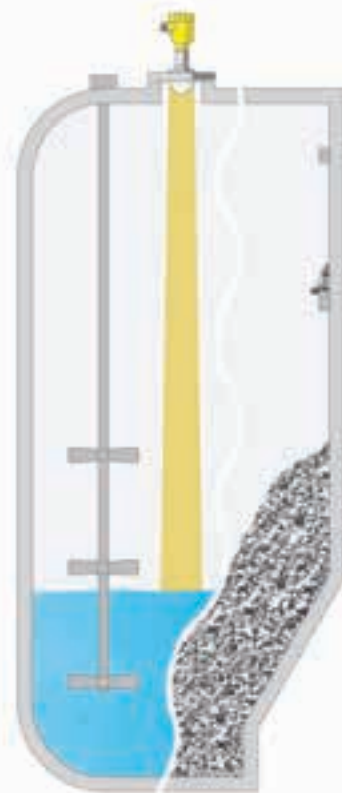
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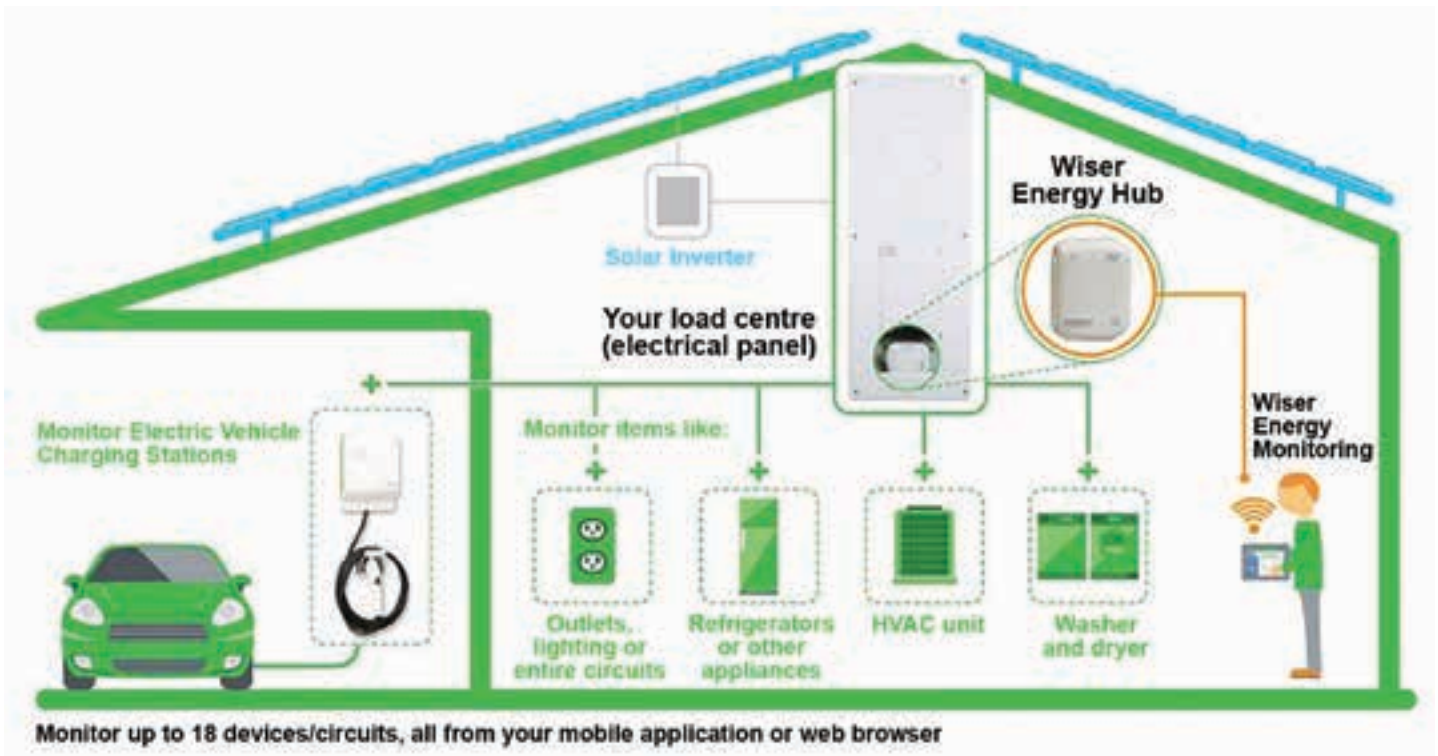
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Schneider Electric's Wiser Energy System enables electrical contractors and solar installers to monitor their customers' energy consumption and solar power generation and remotely diagnose issues. The system can also be easily combined with the company's Square D electrical systems and home protective devices.

ing continues to surge, with estimates that by 2030, it will account for more than 25% of all distances driven globally, up from 4% today," notes Madangombe.

"These changes are just the first hints of what is to come, as we will soon see autonomous vehicles (AVs) and commercial fleets of EVs integrated as parts of everyday life. In the future, AVs will also cost significantly less per kilometre than vehicles with internal combustion engines for personal-use, by as much as 40%, and could also reduce congestion and traffic incidents."

### Cleaner energy closer to customers

We are amid a global evolution toward energy systems that are cleaner and increasingly decentralised, with renewable energy sources and storage technologies being used to generate, store and distribute power closer to final consumers. At the same time, digitalisation will allow customers and electricity system operators to control where, when and how electricity is being used and allow new business models to emerge. Finally, new and more energy uses are going to be electrified – mobility being one of the critical ones.

"These trends have the potential to reinforce each other and actively contribute to making our cities smarter. Forward-thinking business leaders and policymakers must act now to lay the foundation for sustainable innovation in urban environments, able to capture and combine these new trends. If cities and citizens are to receive the maximum benefits, the convergence of energy and mobility must be strategic, intentional and guided," he predicts.



EVlink electric vehicle (EV) charging stations from Schneider Electric offer convenient ways for charging EVs at home, work and any other public or private facility.

"Innovative, IoT-enabled operating technologies from Schneider Electric can help make cities more efficient, resilient and sustainable. Industry 4.0 and the industrial internet of things (IIoT) present new opportunities to unlock process innovations to develop sustainable, environmentally friendly

materials; decarbonise energy; tap digital innovation for doing more with less; and extend the life cycle of goods within a 'zero waste to landfill' framework.

"They also enable the use of the 5Rs approach – repair, reuse, refurbish, remanufacture and recycle," concludes Madangombe. □

## Life is On

Schneider believes access to energy and digital technologies is a basic human right. It strives to empower all to do more with less, ensuring Life is On everywhere, for everyone, at every moment.

The company provides energy, automation and digital solutions for efficiency and sustainability, combining world-leading energy technologies, real-time automation, software and services into integrated solutions for homes, buildings, data centres, infrastructure and industries.

Via its meaningful-purpose, inclusive and empowered values, Schneider Electric is committed to unleashing the infinite possibilities of an open, global, innovative community that is passionate about people and their lives.



# How do we prepare for the disruption of jobs related to IoT?

In preparing future generations for the information revolution, the most valuable educational commodity will be adaptability, writes Rockwell Automation Sub-Saharan Africa Managing Director, Henry Craukamp.



*People will need to be able to learn new knowledge, more quickly. They will need to constantly be able to redefine their technical and critical skills and adapt to new intellectual vistas.*

**T**here's a general anxiety among many people when thinking about what the future of their industry might look like in light of our transition to an Internet of Things-based society: How will the era of artificial intelligence, automation and robots impact on our jobs? And even more extremely, what will the role of humanity be when many of the core jobs of the industrial society are replaced by machines?

There's a flip side to this coin of the human-machine relationship, and reconsidering our anxiety and focusing on the solution will help increase our chances of prosperity over the coming decades.

Already faced with over a quarter of the population being unemployed, the thought that over 75% of current jobs in South Africa will either be rendered obsolete or changed beyond recognition by the fourth Industrial Revolution seems like an extremely ominous challenge on our horizon.

But this doesn't automatically translate to job losses. While highly repetitive tasks are indeed being modernised by digital technologies, making an employee twice as productive does not mean halving the availability of jobs: it is estimated that 85% of the jobs that will drive the world economy in 2030 have yet to be created.

This also means that beyond generalised estimations about the types of skills people

will require to participate in this new economy, we do not know the precise skillsets these new jobs will require. With that being said, as part of its efforts to build essential capabilities in technology areas underpinning the 4IR, the South African Government is introducing subjects such as coding and data analytics at primary school level to prepare young people for the jobs of the future. The pilot will begin at 1 000 schools across the country in 2020.

In our own international Rockwell Automation research and development laboratories, new technologies are constantly being introduced, researched and integrated into our operations. The only way to keep up with these evolving technological demands and build sustainable workforce availability to use and master these innovations, is to ensure we develop the necessary systems and culture to rapidly acquire new knowledge on the shop floor.

It seems then that our most pressing challenge in developing the skills base of the future is two-fold:

First, we need to develop workers that are not just 'adequately skilled', but where a core skill is the very ability to efficiently acquire new skills to adapt to ongoing transformations of their workplace. A focus on STEM skills; the development of new curricula based around IT/OT convergence and IIoT technology; the integration of tools like wearables (virtual

and augmented reality); and a focus on micro certifications will help build essential foundational skills for the employees of the Fourth Industrial Revolution.

Second, using digital technologies we need to ensure that access to new skills and knowledge can be acquired faster and more efficiently. The use of digital media such as augmented reality in production and training environments is receiving growing attention, with several innovative companies introducing it in their training material to centralise their production methodologies; improving consistency and quality. These technologies can also be a useful medium in the challenge we face in retaining the essential 'tribal knowledge' of an organisation and industry, as experienced workers retire and younger workers take their place.

For the moment, these two critical points seem to be pre-requisite factors in ensuring a future workforce that is ready for the jobs of the Fourth Industrial Revolution. □

## Gantry crane positioning technology for Rockwell Automation project

Rockwell Automation required long-distance, no-contact sensors for gantry crane positioning as part of a larger project for South32. SICK offered distance sensors from *Micron to Mile* that are tailored and effective across all distances – something none of the competitors offer.

"SICK's DL100 distance sensors offer fast, reliable and precise positioning over a range of long distances, in all dimen-

sions, in all surroundings" says Prishan Chain, national sales manager: factory and logistics automation. "The wide range of solutions measure from sub-microns to kilometres, where the time-of-flight sensors are not influenced by reflectivity or ambient light – perfect for positioning gantry cranes in harsh environments, such as dusty areas" he adds.

### Ease of Integration

Equipped with high-developed technologies and a wide range of interfaces, SICK sensors are quick and easy to integrate into various PLC systems without the need for major manual modifications. "The integration

technology is highly flexible, in this case via Ethernet," says Chain.

In this project, the distancing sensor head was mounted on the gantry crane. The test bench was at SICK in Lanseria, and live-feed tests between sensor and PLC were conducted on-site.

"SICK's PLC function blocks are written and developed by SICK and available on our website for download, making interface with customers' systems easy-to-use. The project was a Rockwell Automation project where SICK provided the crane positioning technology", says Chain. The gantry crane positioning technology was newly developed for the Rockwell Automation project. □



## Setting the future standard for 3D image

SICK Automation has set the future standard for 3D image processing with regards to technology, speed, resolution and ease of integration with its Ranger3 3D vision camera.

**T**he Ranger3 3D vision camera is capable of taking high resolution 3D measurements of dimensions, contours and surface properties in rapid production and inspection processes to detect the most minute deviations and product faults in production processes.

It achieves this with SICK's innovative rapid-on-chip-calculations (ROCC) technology, which can process up to 15.4 gigapixels per second, enabling full-frame 3D imaging (2 560 x 832 pixels) at a speed of 7 kHz. The contour detection of the laser line, which is projected onto the object, takes place from the ambient brightness or from the visual appearance of profiles, slabs, or pipes flickering with heat, regardless of colour and contrast.

### A case study

IMS Messsysteme GmbH, a measuring systems company in Heiligenhaus, Germany, develops and produces isotope, X-ray, and optical measurement systems for industrial applications in the steel and non-ferrous-metals industry. Its focus is on continuous casting plants, hot rolling mills and tube rolling mills. One of its solutions is the X-3Dvision measurement system, which features between three and eight SICK Ranger3 cameras depending on the type and contours of long products to ensure 360° inspection.

The measurement system checks long-goods profiles and pipes in terms of their dimensions, contours, and linearity, as well as for surface defects such as cracks, deposits, inclusions, or indentations under harsh conditions. To detect faults early, IMS Messsysteme measurement systems are used as far upstream as the thermal processes where profile and pipe temperatures are close to 1 000° C.

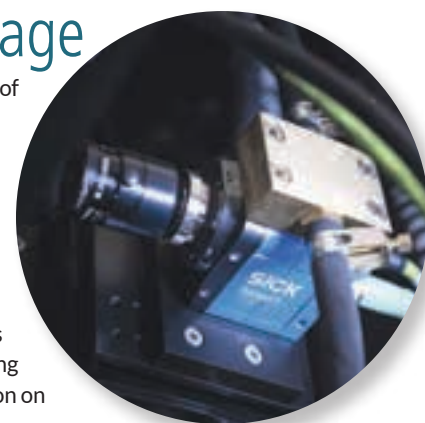
The X-3Dvision measurement systems are used for 360° inspection of products with a wide range of geometric properties. Zvezdan Pejovic, product and sales manager for optical 3D inspection systems at IMS, says that in one of its latest plants the company integrated 22 Ranger3 units. "This allowed us to meet our customer's request for a single, high-precision measurement and inspection system to handle its full range of profiles and sheet piling walls," he says.

The unit's compact design, 55 x 55 x 77 mm, enabled space-saving and application-oriented integration of the camera within the measurement setup. It has a profile rate of up to 47 kHz and a resolution of 2 560 x 832 pixels, meeting the highest requirements in terms of metrotechnical performance. Its state-of-the-art 3D al-

gorithm - offering reliable detection of the laser line on the object - means that the appearance of the profile and pipe surfaces has no impact on the availability and accuracy of the camera. This, despite the potential for flickering due to thermal radiation. Each camera features an optimised bandpass filter as well as an infrared blocking filter to act against thermal radiation on the corresponding laser light.

The CMOS sensor in the Ranger3 converts the laser line recorded on the object into a precise 3D representation. This means that the camera can store complete 3D coordinates for the X-3Dvision measurement system without the need for complex post-processing. The Gigabit Ethernet interface for the streaming camera ensures that large volumes of measurement data can be transferred in real time. "Depending on the application, the cameras are capable of creating up to 24 000 profiles per second, which represents a data throughput for all of the cameras of up to 4 Gigabits per second," says Pejovic.

He concludes by saying that with the help of the Ranger3, IMS not only ensures maximum quality in terms of products and processes, but also opens up new market opportunities for companies. "The high measurement and transfer rates of the 3D vision sensors from SICK open up whole new fields of application for our inspection systems wherever high process speeds are required in production processes." □



The Ranger3 streaming camera, can process up to 15.4 gigapixels per second, enabling full-frame 3D imaging at a speed of 7 kHz.



The X-3Dvision measurement systems from IMS are used for 360° inspection of products with a wide range of geometric properties.

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# AGVs on a safe path with Leuze laser scanners

When using the principle of triangulation for automated guided vehicles (AGV) navigation, vehicles are often equipped with two different scanners – one for safety and one for navigation. Now there is a more cost effective alternative – the new Leuze RSL 400 safety laser scanner, available from Countapulse Controls.

The innovative new Leuze RSL 400 safety laser scanner not only ensures that AGVs are operated safely by means of protective and warning fields, they also simultaneously capture the measurement values for the navigation software. This means that only one scanner is needed for safety and navigation.

Available from leading sensor specialist, Countapulse Controls, the Leuze RSL 400 safety laser scanner makes use of the latest technology, resulting in measurement values with an extremely high angular resolution and accuracy.

The measurement value output of the device is optimised for navigation software, which functions in accordance with SLAM (simultaneous localisation and mapping). These characteristics allow the Leuze RSL 400 to precisely determine the position of the AGV.

The navigation software contains an image of the operating area, including all fixed boundaries. The current position of the AGV is calculated by comparing the measurement values to this map. This concept is referred to as natural navigation.

With each 40-millisecond revolution of its deflection unit, the safety laser scanner emits 2 700 light pulses. These are scattered in all directions, with parts of the scattered light

transmitted back to the scanner. These are used to calculate the distance to an obstacle.

The more detailed and exact the measurement values of the scanner, the more precisely the AGV can navigate. With an angular resolution of 0.1, the Leuze RSL 400 can capture the environment in detail over the entire measurement range of up to 50 metres. This is achieved through a particularly narrow laser spot that maintains its perpendicular shape over the entire scanning angle. It also reduces incorrect measurements, the likes of which can occur on edges.

In addition to the angular resolution, distance values are also important. The Leuze RSL 400 offers an error accuracy of less than 30 mm, resulting in high precision. Use of advanced technology in the device has ensured that the values are not affected by the reflectance of the object, whether it is a reflector or a black wall.

The additional output of the received signal strength value for each beam allows autonomous detection of reflectors by the navigation software. When beams strike a reflector, the values differ greatly from any other environment. This makes simple and reliable detection possible.

Safety is also optimised with the Leuze RSL 400 scanner. The device offers up to 100

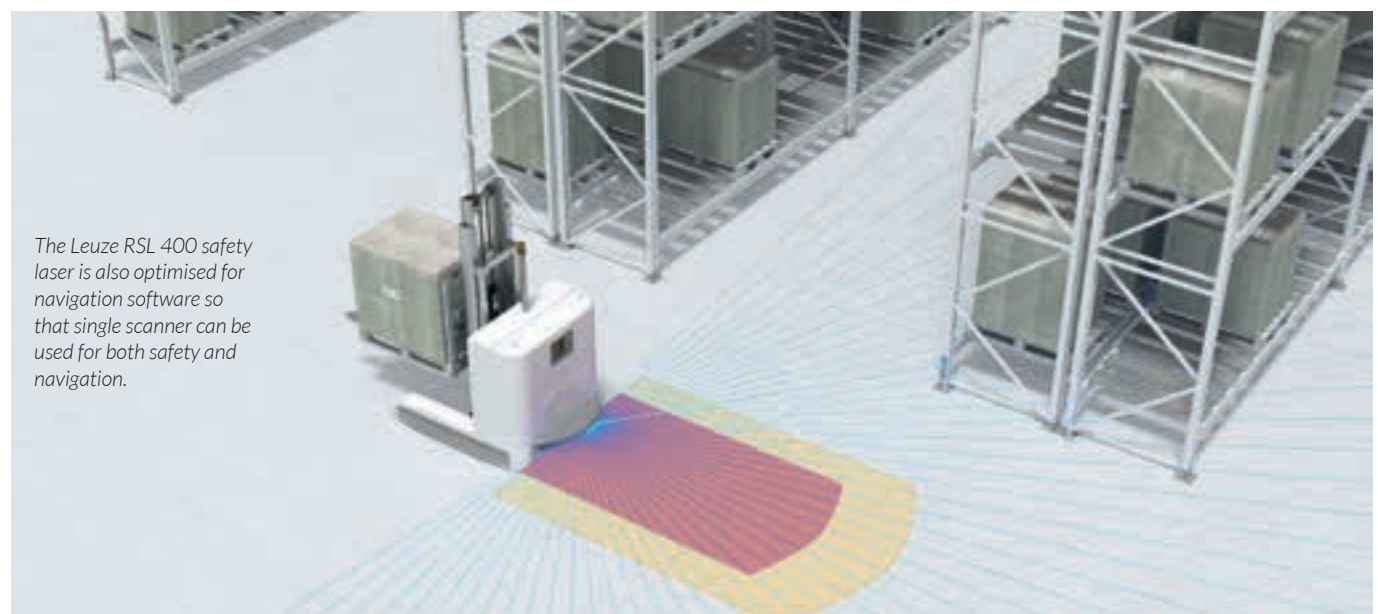


The Leuze RSL 400 safety laser scanner has an angular resolution of 0.1 and can capture the environment in detail over a measurement range of up to 50 m.

switchable protective and warning field pairs. The protective fields can be adapted to the respective movement and load conditions of the AGVs.

For example, in 4-field mode with 50 switchable field sets, the Leuze RSL 400 device can monitor up to four protective fields simultaneously. This enables safe and reliable reduction of the speed of the AGV. With its scanning angle of 270°, the device can also cover the front and side areas of AGV at the same time, that is, it can see around corners. With these features and a maximum operating range of 8.25 m, even large AGVs can be fully safeguarded using only two Leuze RSL 400 scanners.

Available in various models with nine functional variants, three of which have data output for AGV navigation, the Leuze RSL 400 safety laser scanner offers four operating ranges – 3.0, 4.5, 6.25 and 8.25 m. Models available with PROFI-safe/PROFINET interfaces make it much easier to integrate the devices, particularly when many different protective field configurations are used. □



The Leuze RSL 400 safety laser is also optimised for navigation software so that single scanner can be used for both safety and navigation.

# Digital technology drives process and equipment efficiencies

Digital design and simulation technology tools are enhancing Weir Minerals Africa's solution offering to customers, allowing insights into upstream and downstream improvements that optimise mineral processing.

**“W**ith our focus firmly on integrated solutions, we are increasingly able to leverage technology to benefit our customers,” says Christian Stehle, head of engineering at Weir Minerals Africa. “This applies not only to how we design our product solutions, but also to how we help customers examine their whole process.”

Simulation and modelling software tools are key enablers in this quest, says Stehle. They give the Weir Minerals Africa engineering team the power to use computational fluid dynamics (CFD), for instance, to model the behaviour and flow of liquids and gasses.

“In addition to analysing our own equipment, we can also understand more about what happens upstream of our equipment,” he says. “Understanding material flow at various points of the customer's plant process is vital to optimising how our equipment works.”

By the same token, discrete element modelling (DEM) software simulates material flow of solid particles. This allows users to model the flow of material through feed chutes and into our crushers and vibrating screens. The analysis software in this field – like everywhere – is constantly advancing, providing an increasingly detailed understanding of material behaviour.

“Using technology tools like these, we put our mechanical and metallurgical expertise at the disposal of the customer,” he says. “It gives us the ability to make a scientific assessment of where plant challenges lie, while also giving us the power to develop specific solutions to solve the customer's problems.”

The extensive suite of the company's mineral processing products can then be employed to address the challenges that are identified through the use of these technology tools. Stehle also highlights the value of tools



Christian Stehle, head of engineering at Weir Minerals Africa.

like three-dimensional laser scanning, which can be used to map a customer's plant layout and dimensions quickly and accurately. The scanned data is then integrated with Weir Minerals Africa's state-of-the-art computer-aided design (CAD) software to design solutions that fit into the existing plant footprint.

Fast-evolving software also facilitates the application of finite element analysis (FEA) for stress analysis in structural design. As Weir Minerals Africa extends its offerings in comminution, the team puts this technology to work in designing ancillary support structures around its equipment. This includes the design and construction of modular plants for crushing, screening and sand washing.

“We can then provide solutions that are engineered to order, with precision that ensures we get it right the first time. This means quicker installation and commissioning, so there is less downtime for the plant,” concludes Stehle. □

**“In addition to analysing our own equipment, we can also understand more about what happens upstream of our equipment,” he says. “Understanding material flow at various points of the customer's plant process is vital to optimising how our equipment works.”**



The engineering team's use of analysis software provides an understanding of material behaviour.



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# Plastics|SA releases latest plastic recycling figures

Plastics|SA, the umbrella body representing the South African plastics industry, has released the plastics recycling figures for 2018. The latest results clearly show that South Africa has a dynamic, growing and well-supported plastics recycling industry.

“Despite facing major challenges last year, the plastics industry made important strides. Plastic bag manufacturers removed fillers to produce bags that are fully recyclable. In addition, 100% certified recycled plastic material is now used to produce some carrier bags. This creates an end-market for recycled plastic products and helps to reduce waste to landfill,” explains Anton Hanekom, executive director at Plastics|SA.

## Key findings of the 2018 survey

More than 519 370 tons of plastics waste was collected for recycling:

- 46.3% of plastics waste was collected for

recycling, making South Africa one of the best mechanical recyclers in the world.

- Growth in plastics recycling was 6.7% more than the previous year.
- 352 000 tons of new recycled plastic raw material were manufactured to complement virgin polymer in South Africa, a 12.2% increase year-on-year.
- Recycled tonnages grew 64% and virgin polymer 21% since 2009.
- The amount of plastics that was recycled in South Africa during 2018 alone saved enough oil to fuel 200 000 cars for one year – travelling 30 000 km/annum.
- Plastics recycling in 2018 saved 246 000 tons of CO<sub>2</sub> – the equivalent

emissions of 51 200 cars.

- South Africa has 300 active recyclers of which 20% were doing 70% of the tonnages reported.
- The plastics recycling industry provided direct employment to more than 7 800 people and created a further 58 500 income-generating jobs.
- R2.3 billion was injected into the informal sector through the purchasing of recyclable plastics waste.
- 70% of all recyclable materials originated from landfills and other post-consumer sources.
- 34.1% of South Africans do not have access to regular waste removal.

“By ensuring that plastic products become part of a circular economy, we create a win-win situation for the environment and for the industry that employs 60 000 people,” says Hanekom.

## Looking ahead

In order to ensure that the value of plastics is repeatedly harvested and that a sustainable, growing circular economy is developed, Plastics|SA has made the following recommendations:

- **Improve South Africa's waste infrastructure:** Used plastics need to be collected and removed from the environment. An adequate waste management infrastructure – that is able to deal with recyclable as well as difficult-to-recycle waste – must be developed and put in place at municipalities around the country.
- **Reduce contaminants in the waste stream:** Plastics recycling can continue to grow through a collaborative effort to reduce the contaminants in the incoming waste stream, e.g. compostable and biodegradable material.
- **Provide assistance to recyclers:** In terms of challenges within their recycling operations.
- **Develop alternatives for difficult-to-recycle plastics:** There are certain materials and plastic products that are not economically viable to collect, transport or recycle. Solutions need to be developed for these difficult-to-recycle materials.

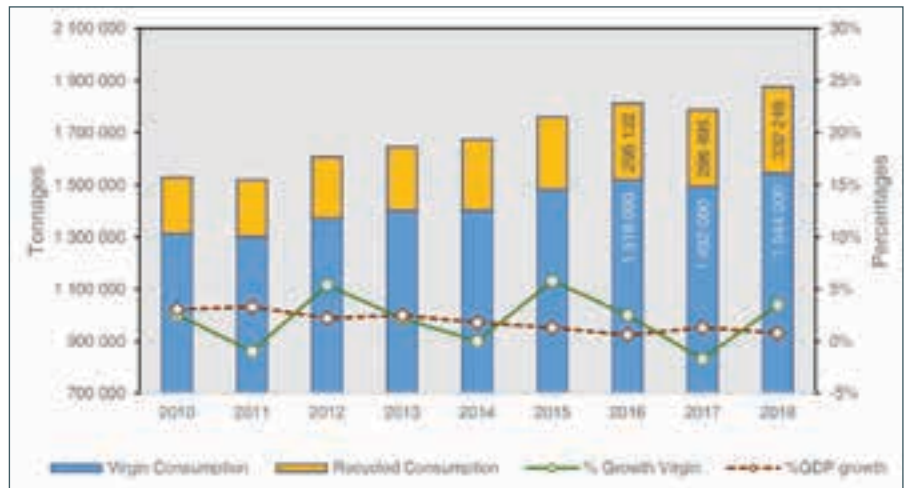
Designing plastic packaging and other products with recyclability in mind and gaining access to good quality recyclable materials before they end up in landfill, continues to be the top priorities that drive the future strategy of the plastics industry.



*“Recyclables are a valuable resource and should be removed from the solid waste stream before reaching landfill where they become contaminated and make extraction costly.*”

Representatives of the plastics and packaging industries, raw material suppliers, converters, brand owners, international fast-moving consumer goods companies, recyclers and environmental organisations are developing a workable, local plan that fits the South African context and environment, as well as the socio-political and economic realities.

“Recyclables are a valuable resource and should be removed from the solid waste stream before reaching landfill where they become contaminated and make extraction costly. Similarly, stakeholders have to work together to manufacture locally, process efficiently and manage the end-of-life products so that they benefit the consumer, the industry and the planet,” Hanekom concludes. □



Domestic polymer consumption in South Africa – virgin and recycle.

## Sappi increases pulp integration to secure supply and decrease costs

Sappi Limited, a leading global producer of dissolving wood pulp, speciality and packaging papers, graphic paper and biomaterials, has announced an agreement to acquire the 270 000 tpa Matane high yield hardwood pulp mill from Rayonier Advanced Materials for US\$175 million.

The acquisition, which is expected to be completed during the fourth quarter of 2019, is conditional pending approval from various competition authorities, and will be funded through internal cash resources and available debt facilities.

“This acquisition will provide Sappi with both cost reductions and decreased volatility at a very competitive price per ton of pulp. Indeed, this is a more cost effective and efficient approach than building additional internal capacity for our North American and European mills,” says Steve Binnie, chief executive officer of Sappi.

Binnie notes, the group earnings excluding special items for the third financial quarter ended June 2019 decreased from US\$155 million to US\$118 million, with profit for the period decreasing from US\$51 million to US\$8 million due to lower operating profit and a US\$9 million once-off finance cost charge for the refinancing of the 2022 bonds.

Commenting on the company’s published results, Binnie said, “Although our 3<sup>rd</sup> quarter is traditionally lower due to northern hemisphere summer holidays, the results for the quarter were under pressure. We faced challenging market conditions across all our major product categories, but in particular from sluggish graphic paper demand in Europe and North America, which necessitated production downtime and weak dissolving wood pulp (DWP) prices due to soft viscose staple fibre (VSF)

markets. In addition, annual maintenance shuts which impact production and sales volumes were completed at Ngodwana, Saiccor and Cloquet mills.”

Notwithstanding a tough quarter, Binnie noted the recent projects to increase capacity at each of Sappi’s DWP mills and convert capacity at Somerset and Maastricht mills towards packaging boosted sales volumes in each of these segments during the quarter, thereby lessening the impact of particularly weak graphic paper markets.

“The company continued to focus on executing a strategy to diversify its product portfolio into higher margin segments to position Sappi for future growth, and I am very pleased that we have taken another significant step towards realising our 2020Vision goal to grow in higher margin growth segments with the Matane acquisition.”

The acquisition is expected to increase Sappi’s pulp integration for its fast-growing

packaging businesses in both North America and Europe; reduce Sappi’s cost of pulp and the volatility of earnings through the pulp cycle; establish certainty of supply for Sappi’s increasing need for high yield pulp to support its recent investments, and enable supply to be increased over time to Sappi’s mills in North America and Europe as demand increases and capacity expands in certain growth businesses.

“We are very pleased to be able to increase our pulp integration for our North American businesses. The acquisition eliminates the need to invest in a pulp expansion project at the Somerset Mill, which for the same investment would have delivered significantly less pulp. At the same time, this acquisition provides us with a healthy market pulp business with a strong customer base. We will work with our new customers during the transition and will of course honour all contractual commitments,” Binnie concludes. □



Located on the south shore of the St. Lawrence River, the Matane mill boasts a capacity of 270 000 mt per annum of high yield hardwood pulp.

# Understanding design choices for vibrating screens

As a leading screening OEM, Kwatani is working hard to raise awareness about the advantages and disadvantages of diverse vibrating screen technologies, making it easier for users to make informed decisions

“When a customer considers options for a screening machine, there are a number of good technologies to choose from,” says Kwatani CEO, Kim Schoepflin. “The appropriate technology choice will depend on the application, and we believe there is a space for every technology.”

Brute force screening is the most common technology employed among mining screens. Its benefits include being generally cost effective, relatively simple to maintain

and economic in terms of life cycle costs, which translate to lower total cost of ownership (TCO).

“Having the mechanical and metallurgical knowledge in-house, Kwatani can provide the technology that best suits the application,” she says. “We are not tied to one technology, and our primary focus is on understanding exactly what the customer needs, and providing a solution that is engineered for tonnage.”

Twin-mass or resonant screens, which run very close to a natural frequency, have a

self-amplification benefit, continues Kenny Mayhew-Ridgers, Kwatani’s chief operating officer, adding that this gives the screen a greater energy-efficiency. “There are, however, limits on the size of these units. In addition, maintenance is more costly as springs or rubbers must be changed regularly or the efficiency benefit is lost,” he says.

Mayhew-Ridgers notes that twin-mass screens also tend to be heavier. This can cause confusion when presenting technology comparisons to customers.

“Often the overall mass of the twin-mass screen is compared with the mass of the brute force screen, and this is obviously not correct,” he says. “Rather, it is the deck sizes that must be compared, as this is the element that does the work.”

While the mechanics that drive the screening process is different, the motion of the panel is what is important. This is where interaction occurs between the particles and the screen panels. The efficiency of the process then depends on the screen’s speed, frequency, drive angle and movement of the panel relative to the particles.

While some proponents will generalise about common challenges with brute force screens, Mayhew-Ridgers notes that these observations are seldom valid. Various manufacturers offer a range of brute force technology solutions, each with its own benefits.

Schoepflin describes Kwatani as a company that works to raise awareness in the industry about what each technology is about. This makes it easier for users to make informed decisions about the technologies they choose. She says it is important for users to be confident that their chosen screen is well supported by local experts.

“It is vital for OEMs to prioritise the customer’s application when considering the basic screen technology and design. While optimising screen panels to achieve higher screening efficiency is always an option, it is not the silver bullet,” she concludes. □



A large Kwatani triple deck screen for a diamond mine.

## mixedROW™: Two flotation technologies in one

FLSmidth’s desire to improve and innovate has led to the development of the mixedROW™ Flotation System, a design that combines two advances – nextSTEP™ forced air and WEMCO® self-aspirating technologies. This flotation solution resolves challenges presented by older flotation systems. In short, mixedROW™ provides boosted productivity, a reduced environmental footprint and higher profitability.

The mixedROW Flotation System exploits the characteristics of two separate technologies. The nextSTEP machines are

placed at the beginning of the row, where they can recover coarse material using the least amount of energy possible. Because of this positioning, mixedROW lowers energy consumption by between 15-40% and increases recovery by up to 5%.

The WEMCO machines are placed at the end of the row, which increases both coarse and fine particle recovery, as a wide range of particle sizes can be treated. The elevated rotor position within the machine also reduced energy consumption because the froth only has a short distance to travel.

MixedROW also has the lowest head loss on the market, due to its carefully engineered system of dart valves that allows efficient transfer of slurry from one tank to another without significant losses. The mixedROW can be adapted to whatever application it is needed, making it a highly flexible and effective solution.

Until quite recently, flotation losses were commonly 50%, reaching as high as 90% for coarse particles. Looking to resolve these substantial losses, FLSmidth’s goal was to create a product that allowed

# Weba Chutes to optimise silo ore flow for South African gold mine

Specially designed ore silo chutes from Weba Chute Systems will be installed at a South African gold mine to reduce mill wear and other processing challenges caused by the uncontrolled flow of mined material into the mills.

**D**eveloped in collaboration with Kwatani, Weba Chute System's solution is tasked to deal with frequent large-size material as the mine has no crushing stage before the milling circuit.

According to Weba Chute Systems technical advisor Alec Bond, the over-feeding of material through the existing manually-operated chutes is causing regular 'mill vomit' in the mine's four mills. The inconsistent feed exacerbates wear on mill bearings as the material's weight shifts forwards and backwards inside the mill.

The waves of material which cause the 'mill vomit' carry insufficiently milled material out of the mill, including large chunks of rock. This leads to problems for the downstream mineral processing facilities, including inefficient recovery in flotation cells and even blockages in pumps, says Bond.

"The challenge starts with the existing chutes – requiring constant supervision and control by operators – being opened and closed with a chain block device," says Bond. "Our solution was to design a robust, self-controlling chute and feeder system that would ensure an even flow of material into the mills."

The mine's existing system has no means of closing the silo outlet; any maintenance at the chute area requires the emptying of the



One of the specially designed ore silo chutes from Weba Chute Systems installed at a South African gold mine.

silo and stoppage of the mill. Each of the four silos has three outlet chutes.

"We therefore added a spile bar arrangement which seals off the silo," says Weba Chute Systems designer Wesley Hunkin. "The chute, which is choke fed, is placed under this installation. This allows the feed rate to be controlled by the Kwatani feeder, which has been integrated into the chute design."

A serious challenge is over-sized rocks in the ore feed, which can be up to 800 mm in size. This makes it important for chute designs to accommodate the worst-case scenario of chutes choking, says Hunkin.

He highlights that the flow of material

is also controlled to prevent direct impact onto the conveyor belt feeding the mills, and to ensure central loading onto the centre of the belt.

"If the material from the feeder is biased to the one side, our chute brings everything to the centre of the conveyor," he says. "This enhances the consistency of material flow into the mill."

"Our solution promises direct savings in terms of mill bearings, as well as less mill downtime. There will also be significant gains in terms of recovery rates in the plant if the flow and size of milled material can be improved," Hunkin concludes. □

customers to have more control over the froth recovery process. With this in mind, the Froth Recovery Upgrade Package was designed. It offers a range of equipment that has been engineered to improve the productivity of froth recovery, while minimising the losses of valuable particles.

Redesigned features include: the use of actuators to control the position of the improved dart valves inside the flotation cells; level sensors to sense slurry levels at the highest accuracy on the market; and radial froth crowders that reduce top-of-froth surface area and increase froth movement to the nearest radial launder, enabling

deeper froth or faster froth removal.

The result of the new and improved designs are quicker reactions to flow and slurry density changes, which dramatically boosts the performance of flotation machines. All the elements working together in combination with radial froth crowders means this package will deliver better recovery at the same grade or increased grade at the same recovery. □

*FLSmidth's mixedROW flotation technology offers the lowest head loss on the market, due to its carefully engineered system of dart valves that allows efficient transfer of slurry from one tank to another without significant losses.*



# Representative sampling – key to success in Africa’s commodities

“West Africa is a growing market for Multotec samplers and services, with the increased output of commodities adding a new dimension to the importance of the company’s equipment. Multotec’s Willem Slabbert explains.

The growth and diversification of West Africa’s mining sector is making the precision of mineral sampling a vital priority, according to Slabbert, a process manager at Multotec Process Equipment.

For over two decades, Multotec has been active in the West African market, with its proven samplers at over 30 sites in countries including Ghana, Liberia, Burkina Faso, Guinea, Sierra Leone, Mali and Guinea-Bissau. A range of commodity sectors use the equipment for both slurry and dry sampling applications, among them gold, bauxite, iron ore and heavy minerals.

“In bulk minerals like bauxite – where our sampling plants have been in operation with a major West African producer for 17 years – the sampling protocol and ‘correctness’ of equipment design is key to ensuring bottom-line success,” says Slabbert.

He highlights the importance of reproducible and accurate sampling at the interface between the mine and port, and on the ship-loading conveyor to the client.

The sampling, which must comply with ISO standards and best practice as prescribed

by the Theory of Sampling (TOS), confirms the mine is supplying product to the end-customer’s contractual specification. “Any imperfection in the sampling process can lead to unnecessary contractual disputes and potential financial losses for the mine or client, which is why we also presented representative sampling training courses explaining the practical aspects of implementing the Theory of Sampling (TOS),” he says.

Multotec supplies wet slurry samplers to many gold mines in West Africa, who rely on good gold accounting and reconciliation at their processing plants. The equipment is popular among large gold producers as well as the smaller entrants.

“With a comprehensive range of two-in-one, primary and ancillary samplers, we are able to tailor each installation to the customer’s specific application,” says Slabbert. “This means accommodating variables like throughput rates and slurry densities; including accounting for grade variability from various mine sources feeding a single processing plant in many of the West African deposits.”

Slabbert explains, by drawing on its expertise across a range of disciplines, Multotec can



Willem Slabbert, applications and process manager at Multotec Process Equipment.

put specialists, engineers, design draughtsmen and millwrights to work on projects throughout the West African territories. This ensures optimal placement and performance of equipment to safeguard customers’ profitability. For brownfield projects, he concludes, this means Multotec can design solutions to suit and fit the structural constraints of the customer’s existing infrastructure. □



Bias-free sampling is a non-negotiable for any mining operation, and Multotec has a comprehensive range of samplers, wet or dry, to suit various applications.

# Fibertex celebrates women at workshop event

Fibertex SA marked women's month as a platform to showcase the company's commitment to empowering through diversity by hosting a 'Women in Engineering Workshop' at the KZN manufacturing plant.

**"T**o celebrate female engineers working in the built environment, we invited ladies from all sectors of our business to attend our event, including guests from engineering consulting and architectural firms, educational institutions and the eThekweni Municipality," explains Meera Govender, technical sales engineer for Fibertex SA.

One of the highlights of the day was a motivating address by the key-note speaker, Jeshika Ramchund, lead engineer – developments, for Bosch Projects, who shared her journey, highlighting the challenges she faces in the industry and tools she utilises to achieve her success.

Jeshika, who is passionate about the engineering industry and who is committed to working hard to improve the lives of many South Africans, had a powerful message of encouragement for the all guests in attendance: women must focus on being the best at what they do. This made her the ideal candidate to partner with the Fibertex team to present the common message.

In the past year, she has been awarded the 2019 CESA Young Engineer of the Year Award; the 2019 SAICE Durban Young Engineer of the Year Award; the 2018 SAPSA Engineering Young Professional of the Year Award and was also selected as one of the Mail and Guardian's 200 'Young South Africans to Watch' in 2018, in the Science and Technology category.

The Fibertex Women in Engineering workshop comprised a technical presentation on the Introduction to Geosynthetics and its applications; an interactive discussion about the challenges of gender diversity, and a tour of the plant.

Guests were shown the process of non-woven staple fibre geotextile products being manufactured from raw Polypropylene (PP) fibres and were impressed that Fibertex UV stabilised virgin PP geotextiles are the only nonwoven geotextiles produced in Africa with certification for durability of over 100 years.

The specialists in Geosynthetic products recently achieved Continuing Professional Development (CPD) accreditation from the South African Institute of Consulting Engineering (SAICE) for its specially-developed course on the 'Introduction to Geosynthetics and Soil Reinforcement'. The company plans to obtain further accreditation for other courses, which will be presented to the local market by technical specialists at Fibertex.

"The Fibertex team plays an important role in civil engineering and construction projects



The key-note speaker, Jeshika Ramchund, Lead Engineer – Developments, for Bosch Projects. Jeshika.

in Africa, offering a technical support service to ensure correct specification of durable and safe materials, for high efficiency and extended service life, in every project.

"Support from the holding company in Denmark guarantees the global edge on product design, impeccable manufacturing standards, cost efficiency, safety and reliability of every Fibertex material," concludes Govender. □



The Fibertex Women in Engineering workshop comprised a technical presentation on the introduction to geosynthetics and its applications; an interactive discussion about the challenges of gender diversity and a tour of the plant.



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## Clear visibility – Kobold’s self-cleaning flow indicator for liquids

To check the flow processes in pipeline systems and for insight into the interior of process pipes, many flow indicators are used where the flowing medium sets a rotor turning and visibly signals a flow.



INSTROTECH is offering Kobold’s DAA self-cleaning flow indicator, with the unique characteristic of the rotor being housed in a rotatable glass cylinder. This version ensures a functional flow check from two points of view. On one hand, its construction as a visible cylinder gives a relatively large and easily observed field of observation; in addition, the rotary

movement of Teflon rotor permits reliable monitoring of cloudy or dark media due to its noticeably bright colour.

This type of device is already widely used and has proved itself in industrial use thanks to its functional reliability. The unique design and construction of the DAA flow indicator, specifically the incorporation of two wiper elements has resulted in a product first – combining a flow indicator with a device that allows the equipment to be cleaned during operation. The sight tube is rotated so that the wiper elements concentrate the dirt into two narrow strips on the interior of the glass. From there it is taken away effortlessly by the flow.

The Borosilicate glass tube is fitted with O-rings which slide easily, so that the cleaning of the unit can be carried out by hand even under full operating pressure. The flow indicator with integral cleaning

device can be used in any position for checking the flow of gases and liquids. A choice of sizes is offered and flow rates of 0.4 l/min up to 100 l/min H<sub>2</sub>O can be reliably checked. Along with the standard housing version in brass, the units are also offered in a resistant stainless-steel version for aggressive media. If the rotor is unwanted for particular applications, for example increases in flow rate, the unit is also available with just a sight glass with cleaning device.

- DAA Key features:
- Viscosity: 1- 150 mm<sup>2</sup>/s
  - Indication range: 0,4-4...8 – 1–l/min water
  - Pressure: maximum 16bar; temperature: maximum 100°C
  - Connection: G¾...G1½ female; ¼”...1½” NPT
  - Material: brass, stainless steel

[www.instrotech.co.za/Products](http://www.instrotech.co.za/Products)

## Quality imperative in engineered walkway products

Andrew Mentis has made it its business to manufacture quality walkway products for over 65 years. According to Lance Quinlan, national technical sales consultant at Andrew Mentis, the company has a solid track record of quality manufacture when it comes to engineered walkway materi-

als including RS40 grating, expanded metal and Die Line. “We simply do not compromise when it comes to quality,” says Quinlan.

Quinlan believes one of the most commonly-known of all walkway products in industry is the Mentis RS40 40/40 floor grating. He says, “This is our number one premium brand, and is often considered the floor grating to have.” He notes that the product has the kind of top-of-mind awareness in its market similar to what Hoover has enjoyed in the vacuum cleaner market.

“The design, engineering and manufacture of steel floor grating products have particular relevance to their structural integrity, and floor grating should always be viewed as an engineered product,” says Quinlan. “The most important factor in flooring is the load-bearing capacity of the

product. It is formed through a process of compressive locking of the load bearing flat bars (bearer bars) and the round bar transversals to form an exact 40 mm<sup>2</sup> pitch with openings of 35,5 mm x 32,4 mm and is designed with specific load-bearing characteristics.”

Quinlan notes that expanded metal also has a wide range of flooring applications, and is ideal for catwalks, conveyor and access walkways and platforms. Good examples are walkways on large billboards, which need to ensure safe access to the billboard, as well as maintenance walkways on process plants.

As a complete industrial flooring supplier, the company can help customers identify the most appropriate flooring solution for their application requirements.

[www.mentis.co.za](http://www.mentis.co.za)

## Kwikspace appoints new Human Resources Executive

An experts in modular building, Kwikspace has appointed Busisiwe Kubheka as Human Resources Executive.



From 2009 to 2017, Kubheka was employed as Human Resources Manager at Kwikspace. In her new role, Kubheka will be leading both Human Resources and Industrial Relations strategies. She will be implementing policies and procedures to ensure the company’s growth and the management of Kwikspace’s organisational culture, as well as Talent Management.

A member of the IPM (Institute of People Management) and the SABPP (SA Board for People Practices), Kubheka is currently completing her MBA.

[www.kwikspace.co.za](http://www.kwikspace.co.za)



The most important factor in flooring is the load-bearing capacity of the product.



## Becker Mining provides for world's largest friction hoists

Becker Mining SA has supplied the rope attachments equipment currently being fitted to the winder ropes of the world's largest friction hoists. This equipment has been designed and manufactured by the Becker Mining team in South Africa, to meet specific winding requirements of a leading copper mine in Mongolia.

"Becker Mining's rope attachments equipment consists of both running and spare sets of rope attachments for all three winders being installed as production, service and auxiliary hoists," says Tom Searle, senior general manager: capital, Becker Mining South Africa.

"The production hoist rope attachments consist of six strings of hydraulically adjusting headrope sets, six strings of fixed head rope sets and 12 sets of tail rope attachments. A complete spare set, which is identical to the running set, was also supplied.

"The service hoist has identical attachments to the production hoist and is enhanced by a complete set of spares.

"Both the production and service hoists, which are friction winders, are the largest mine winders of this type ever to be installed."

Becker Mining's dependable equipment gives mines the assurance of many years of safe transportation of personnel and materials to and from underground operations.

The company's specialist services to the mining sector comprise energy distribution, communications and automation solutions, mechanical and transportation systems and steel arch roof supports.



*The production hoist rope attachments consist of six strings of hydraulically adjusting headrope sets, six strings of fixed head rope sets and 12 sets of tail rope attachments.*

[www.za-becker-mining.com](http://www.za-becker-mining.com)

## Hytec Hydraulics Botswana opens Service Centre

Hytec Hydraulics Botswana officially opened its Service Centre in Gaborone on 13 June 2019.

As the largest manufacturer and supplier of hydraulic, pneumatic and automation components and systems in sub-Saharan Africa, Tillmann Olsen, CEO for Bosch Rexroth South Africa, said the new workshop in Gaborone symbolises the ambition to set the highest standards in all areas of business. He said that Hytec Botswana will be supported by the Rexroth HUBB in Johannesburg where there is a concentration of highly skilled employees. "The HUBB's training facilities will enhance the knowledge of current and future employees across the continent", said Olsen.

As a dedicated member of the Botswana Chambers of Mines (BCM) Hytec Botswana's official opening was attended by premier mining decision makers and stakeholders.

Charles Siwawa, CEO of the Botswana Chambers of Mines, said that he was looking forward to sharing product knowledge and expertise to suit local specialisations. "Development and deployment of the right skills within the industry will play a crucial role in the efficient execution of the BCM's mandate," he said.

[www.hytecgroupp.co.za](http://www.hytecgroupp.co.za)



*Hytec Hydraulics new Service Centre in Botswana.*

## Trafo supplies transformers for data centre application

Trafo Power Solutions recently supplied two 2 000 kVA 11,6 kV/415 V dry-type transformers to a large data centre in Cape Town; ensuring reliable supply and energy savings.

David Claassen, managing director of Trafo Power Solutions, explains that data centres are energy hungry beasts that operate with a high-power demand, and it is important that the most appropriate transformers with the requisite protection devices are specified for this robust application.

This means understanding the data centre applications, the load which the transformer will be supplying, as well as the type of switchgear that will be feeding it. "This," he says, "is important from a voltage transient perspective".

Manufactured under stringent quality



*The specialised transformers for the data centre in Cape Town are low loss transformers which conform to the European Directive EU 548-2014.*

control conditions at Italian transformer OEM TMC, 2 000 kVA 11,6 kV/415 V dry-type specialised units are low loss transformers which conform to the European Directive EU 548-2014 and will provide greater energy savings in this application.

"Dry-type transformers are ideal for data centre applications, and correct upfront design played a role in ensuring that these transformers will meet the application requirements," Claassen says.

These transformers were designed differently to a standard distribution load transformer and have an electrostatic shield which diverts noise to ground as well.

"Trafo Power Solutions was able to assess the application requirement and provide a solution that could be delivered within a tight delivery time frame, which was an added advantage to the end-user," concludes Claassen.

[www.trafo.co.za](http://www.trafo.co.za)

## Maintenance critical to any responsible business

With effective maintenance management a key driver of delivery in most industries, many South African engineering firms are investing far more in technology to

increase already slim margins and improve efficiencies.

Managing director of Brimis Engineering, Andile Nqandela, notes that delivering complex maintenance schedules can add value to any organisation and the community they operate in, therefore the maintenance process needs to be carefully planned for each individual plant or system.

While this often includes staff training or planned maintenance, he says, it also needs to ensure that maintenance looks beyond survival tactics to ensure uncertainty in operating systems is minimal. This applies to machinery and devices such as valves, but more importantly to human operators.

“In our current economic climate, cost cutting and Return on Investment (ROI) have become top of mind. The fact

remains that maintenance has tangible benefits and can impact the bottom line,” says Nqandela. “Brimis Engineering is a company that specialises in the fitment, maintenance and supply of valves, and has seen first-hand the necessity of risk-based maintenance of safety critical valves.”

Brimis Engineering is working towards providing remote access for clients to witness valve testing and reduce travel time for those clients who attend testing. The valve test bench and lifting inspection divisions will allow for remote witnessing of certification and documenting of statutory calibration tests. This will reduce travel time for the client and third party inspectors, over and above the secure cloud storage of test and calibration certificates.

[www.brimis.co.za](http://www.brimis.co.za)



The pressure relief valve test bench use by Brimis.

## BMG and AAC team up for a clean environment in Jeppestown

The joy of teamwork is clearly evident in the partnership between engineering specialists, BMG and entrepreneurs, Agri Arts & Construction (AAC).

With BMG's assistance, AAC now has a corporate identity design, working uniforms and tools selected from the Tools &

Equipment division.

“The BMG team is not only proud to work with AAC, but we also enjoy a close association with Jeppestown's urban developers, who are committed to improving the quality of life for this community. The Bjala Foundation is currently developing

affordable housing and a healthy urban environment in the city. In fact, many BMG staff members now reside in re-vamped apartments in the area. Bjala's programme also involves the provision of education in the area, skills development and job creation, as well as improved safety and a clean environment.”

A key motivator of these initiatives – Malibongwe Sithole, director of Agri Arts & Construction and Bjala's community liaison officer – says, “Our partnership with BMG has changed our lives for the better. The company has offered more than we expected and this is an honour for the team.

“We feel important and we are proud to play an active role in keeping our environment clean. We have recognition and a sense of belonging to a community”.

Sithole is also a consultant to Aquaponics & Hydroponics and Chairperson of the KwaMai-Mai Market in Jeppestown. He plays an active role in many community activities, including the Sector Crime Forum (SCF), Jeppestown Building Information Forum (JBIF), Scouting and other voluntary services.

[www.bmgworld.net](http://www.bmgworld.net)

## Barentz partners with SK Chemtrade Services

Leading global ingredient distributor, Barentz International, is continuing its expansion in South Africa by announcing a joint venture with SK Chemtrade Services, a leading supplier of high-quality raw materials to the life sciences industries in South Africa and neighbouring countries.

Commenting on the announcement, Mark Ferrao, managing director of SK Chemtrade said, “As a strong strategic partner based in Europe, Barentz is an excellent fit. Both of our companies have the same ethos; delivering high-quality products and offering technical support whenever required, with an enthusiastic approach to product development”.

For Barentz, the new collaboration is a

logical next step because SK Chemtrade and Barentz are active in the rapidly growing life sciences industry. Barentz' CEO Hidde van der Wal says, “We are naturally cut out to be partners. As a joint venture partner in SK Chemtrade, we will have quicker access to the market in Southern Africa. SK Chemtrade is well-known and well managed and has a strong reputation. This partnership will provide a solid base for creating robust business opportunities in South Africa and its neighbouring countries.”

Van der Wal explains with the new SK Chemtrade product-development laboratory, both companies will be able to create synergies and value for all their customers.

[www.barentz.com](http://www.barentz.com)

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## Efficient handling of paper rolls

BLTWORLD's extensive range of materials handling equipment, encompasses Meclift variable reach trucks, which are equipped with paper clamps, for the efficient handling and loading of paper rolls and sawn timber in and out of trucks and railway carriages.

"The Meclift ML1812R, which is a multi-purpose forklift truck, moves swiftly in confined spaces, like warehouses and cargo vessels and can also be operated inside containers, for easy loading and unloading of paper rolls. This cannot be achieved by conventional forklift trucks," says Ken Mouritzen, managing director, BLTWORLD. "These compact and robust reach trucks increase efficiency and safety during paper and timber handling, also reducing operating times and safety on site."

"In addition to handling in the paper industry, the ML1812R machine - with a lift height of 6 m and a lifting capacity range of 18 tons - is perfect for almost any other material handling requirement in every sector."

By extending, lifting and lowering horizontal booms, paper reels can be safely handled at a distance from the cabin. This cabin can be raised or lowered to provide

the driver with improved visibility in all situations. Other safety features include service, parking and emergency brakes.

An important feature is that fork positioning can be altered from inside the cabin, without the operator having to get out to manually adjust the gap between the levers. Forks are available in different lengths, widths and thicknesses according to exact requirements.

The lifting carriage of this machine has a hydraulic side-shift for accurate and effortless positioning. The cabin's hydraulic vertical movement facility of 650 mm enables the operator to comfortably drive into a container.

Meclift variable reach trucks are powered by a diesel engine and are economical to run, requiring minimal maintenance.

BLTWORLD, which supplies a range of specialist materials handling equipment to diverse industries throughout Africa, also



Meclift variable reach truck with paper clamp attachment for efficient handling of paper rolls.

offers a technical advisory, spare parts and support service. Operator training and a condition monitoring service for equipment are also provided.

BLTWORLD's Meclift variable reach trucks, equipped with paper clamps, are used for the efficient handling and loading of paper rolls and sawn timber in and out of trucks and railway carriages.

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# Biomimicry and the life-friendly economy

*MechChem Africa* talks Claire Janisch, head of biomimicrySA. Janisch promotes the practice of biomimicry in business strategy, technology and education. She was also a co-creator of the Genius Lab, an experiential learning organisation that inspires innovation and future thinking.

“I studied chemical engineering and completed a Masters in Environmental Process Engineering, with the idea of improving mainstream processing to reduce environmental impacts. For ten years following my graduation, I worked in environmental engineering with a focus on some of the most hazardous industries: mining, minerals processing, metal plating, cement and agricultural fertilisers.

“The purpose of these processes is to generate functional materials and services to improve standard of living, yet many of them use toxic materials in their processes and vast amounts of water and energy. A great deal of waste is generated, which has to be cleaned up to prevent danger to people and the environment. Is it not possible to meet our functional needs without generating such a mess?” she asks.

“When I was introduced to biomimicry I realised that it is. We can make almost everything in chemical engineering in ways that are nourishing to life. Almost every functional material or process has a counterpart in nature that uses life-friendly materials, low energy processes and continuously cycles all the materials used, including water and carbon,” Janisch informs *MechChem Africa*.

She cites a 2014 article in *Forbes* magazine that identified the top five trends driving company success. Biomimicry was Number 1,

with additive manufacturing (AM); software, big data and the Internet of Things completing the list. “While everyone knows that 2 to 5 are exponential technologies driving the 4<sup>th</sup> Industrial Revolution, where does biomimicry fit in?” she asks.

Claire Janisch argues that, in fact, all these exponential trends are rooted in biomimicry. Robots mimic the hands and limbs of living species; drones are only just getting close to achieving the flight and vision capabilities of nature’s dragonflies; neural networks strive to copy how the brain remembers, makes links and learns; digital intelligence connects individuals in distributed networks similarly to the swarm intelligence of nature’s social species; and the IoT echoes the central nervous system, using smart sensors that are nowhere near as finely tuned as those used by insects and animals.

“Think about data storage. We know that a few grams of DNA can store a billion terabytes of data. And with respect to sustainable energy, nature has been running on sunlight for millions of years. 3D printing is also nothing new. Every one of us was created cell by cell, layer by layer, as was every living organism,” Janisch points out.

“I liken the solutions found in the natural world to running a four minute mile. Once we knew it was possible, many started to do so. Similarly, now that we know it’s possible



to meet our functional needs in life-friendly ways at very low temperatures, it’s a matter of time before we are able to reverse engineer these options and create highly functional industrial materials that are non-toxic, use low-energy and cycle water and materials in regenerative loops.

“Many of the recipes, processes and systems strategies are there, hidden in plain sight, just waiting for us to recognise their potential and put some effort into reverse engineering a biomimicry solution,” she argues.

“The potential is huge. And we are in a better position than ever before to take advantage. 3D printing and nanotechnology make it possible to more accurately mimic the way a spider weaves its web, for example, by depositing layer upon layer of protein hydrogels that quickly set into silk as the water dries off.

“Not only can we now mimic these processes, but with advanced equipment such as electron microscopes, we can also study how nature works in much finer detail. We can see and make sense of the vast number of functions taking place on the nano-scale. Better research capacity makes it easier to recognise and understand nature’s processes, while technologies such as nanotechnology, 3D printing and advanced computing make it possible to mimic nature to develop benign materials and low-energy manufacturing processes,” she explains.

The use of biomimicry in engineering is not new. One need only look at early designs of flying machines to see that early inventors such as Leonardo da Vinci were mimicking nature. But they were limited by the available materials and technology of the day.

“From a modern design perspective, the limits are now significantly extended and we believe biomimicry should be the first thing engineers turn to when striving to improve or develop a new material, product, system or industrial process,” she tells *MechChem Africa*.



*Nothing is cast out of a forest as waste. Sunshine and water collection are optimised in each context and the interactions between all species has evolved and adapted over thousands of years to be resilient and regenerative.*

## The circular economy and ecosystems

Human engineering has long claimed to be able to make products and processes more efficiently than nature. The pursuit of higher and higher efficiency solar panels is one example. To make these panels, however, toxic chemicals and large amounts of energy are needed – emitting large amounts of CO<sub>2</sub> during manufacture – and after use they end up in land-fill.

A leaf, on the other hand, uses the energy of the sun to 3D-print a life-friendly polymer at low temperatures with carbon as a raw material, all while cycling carbon, breathing out oxygen and driving the rain cycle. And when it's life is over it ends up as compost, feeding the soil. Nature's advanced technologies such as these are continuously creating conditions conducive to life.

At a systems level, this is far more efficient than humans achieving high-efficiency for a single component such as a solar panel, while ignoring expensive externalities across the product's life-cycle, such as raw material extraction, manufacture, use and disposal.

According to a report by environmental consultancy Trucost on behalf of The Economics of Ecosystems and Biodiversity (TEEB) programme sponsored by the United Nations Environmental Program, "none of the world's top industries would be profitable if they paid for the natural capital they use." These unpriced natural capital costs include greenhouse gas emissions (38%); water use (25%); land use (24%); air pollution (7%); land and water pollution (5%), and waste (1%).

The report found that the total unpriced natural capital consumed by the more than 1000 global primary production and processing industries amounted to US\$7.3-trillion per year, equivalent to 13% of global GDP in 2009.

"In comparison, naturally evolved processes integrate all these externalities, yielding systems-level efficiencies," says Janisch.

Ecosystems such as forests, grasslands and coral reefs, continue to grow and develop over centuries, cycling all materials and contributing to the conditions that ensure the system and life thrive – building soil, cleaning water and generating a safe cocktail of gases that supports life.

Nothing is cast out of a forest as waste and even urine and faeces are recycled for use as food and fertiliser. Sunshine and water collection are optimised in each context and the interactions between all species have evolved and adapted over thousands of years to be resilient and regenerative. These environments are the ideal of a circular economy.

"Using biomimicry as model, measure and mentor, it is possible to emulate nature's ecosystems in many ways, which is why biomimicry and the circular economy go so well

together. This is simply a better and more logical way to design and manage our systems to emulate the nourishing systems that support all life. Examples include:

- **Biomimicry materials:** Spiber, a Japanese company, has managed to emulate the recipe of spider silk, making a range of tough and lightweight materials that are built out of proteins, but can be used for highly functional applications such as shock-absorption. Spider silk is five times stronger than steel and more flexible than nylon, yet it's made at the cold-blooded temperature of a spider, out of dead insects and water. Prior to Spiber's materials' innovation through biomimicry, the nearest equivalent to spider silk made by humans was Kevlar, which is made by boiling petrol in sulfuric acid and then extruding it at high pressure. This is one of many examples of how biomimicry could yield highly functional materials that are made using low-temperature life-friendly recipes.

- **Biomimicry processes:** Rather than using chemicals to treat wastewater, Eco-Machines by John Todd Ecological Design mimic a natural ecosystem where a diverse set of interacting organisms clean contaminated water via naturally occurring processes.

Components of this natural ecosystem collectively contain organisms from all five kingdoms of life. Aquatic and wetland plants, bacteria, algae, protozoa, plankton, snails and other organisms are used in the systems to provide specific cleansing functions as part of a balanced food-chain.

Wetlands are one of the main kinds of ecosystems imitated in Eco-Machines, as they typically contain water-loving plants that thrive in high-nutrient environments. Other Eco-Machine designs mimic soil eco-systems and all of them use biodiversity as a fundamental to their designs.

- **Biomimicry systems:** "Why can't we design our city infrastructure to provide ecosystem services rather than relying on external ecosystems to provide these? "Biomimicry Ecological Performance Standards are challenging cities to provide the same ecosystem services as the native ecosystems they cover over – can cities capture and cycle water, sequester carbon, clean the air and cycle critical nutrients in the same ways as native ecosystems do?"

"Work in this regard has been done for the city of Durban. Similarly, Interface Carpets is currently building a factory in Australia that aims to provide the same ecosystem services as the native ecosystem where it is being built. So instead of the built environment striving to minimise



*Biomimicry materials specialist, Spiber, with Goldwin Inc, the distributor of The North Face brand, have produced a concept 'Moon Parka' using synthetic silk from proteins that mimic spider silk.*

its impact, the built environment contributes to the ecosystems in which it is situated. Cities can act as water catchments themselves instead of relying on dams far away. Similarly they can capture their own energy and cycle their own wastes, transforming them back into value again and generating more and more economic opportunities in the process," Janisch argues.

"Chemical engineers have a huge role to play in the potential shift in civilisation that comes from the emulation of nature's materials, processes and systems. We are the ones that contribute to the design and scaling of currently toxic processes of human civilisation – mining, oil, plastics, textiles, pesticides, etc – as well as the generation of most of the waste and pollution from human systems – plastics in the ocean, pesticides in water-ways, air emissions, etc. But we also have the capacity to figure out how to reverse engineer and scale up more life-friendly biomimicry alternatives.

"If biomimicry thinking is adopted as a core tool in the chemical engineering toolbox, we can find solutions to many of the current systemic problems of our time and begin to develop materials and processes that are well-adapted to life on earth." Janisch concludes. □

# Garnet delivery system for waterjet cutters

**F**lexicon's new JET-FEED Garnet Delivery System automatically feeds garnet directly from bulk bags to waterjet cutters, eliminating worker fatigue, potential injury, labour, spillage, dust, downtime and higher material cost, which is associated with

manual dumping of bags typically weighing 25 to 50 kg.

The BFF Series BULK-OUT bulk bag discharger allows floor level connection of bag straps to a lifting frame, which is forklifted onto cradles of spring-loaded POP-TOP extension posts. The weight of the full bag compresses the posts, which stretch the bag upwards when it empties/lightens in order to promote flow.

The bag outlet spout is pulled through an iris valve which is then closed, preventing material flow while the spout is untied and the access door is closed. Releasing the valve slowly prevents uncontrolled bursts of garnet into the hopper and dust into the plant environment.

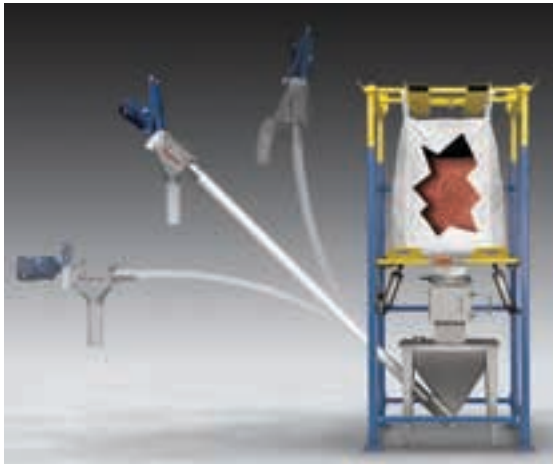
The discharger employs FLOW-FLEXER bag activators that raise and lower opposite bottom sides of the bag at timed intervals, loosening compacted

garnet and promoting flow into the bag discharge spout. As the bag lightens, the stroke of the bag activators increases, raising the bag bottom into a steep "V" shape, as the spring-loaded posts stretch the bag upwards, promoting total discharge.

The floor hopper charges a Flexicon flexible screw conveyor, which can be routed vertically, horizontally or any angle, over short or long distances, to the waterjet pressure pot location.

The only moving part contacting garnet is a rotating screw that self-centres within the abrasion-resistant polymer tube, preventing garnet from grinding between the screw and tube wall. The screw is driven beyond the point at which garnet exits the conveyor, preventing contact with seals. The rugged inner screw is the only moving part contacting material, limiting maintenance to periodic lubrication of the electric drive motor.

The conveyor can be started and stopped manually, or automatically by a PLC linked to high and low level sensors installed on the pressure pot. □



JET-FEED™ Garnet Delivery System from Flexicon transfers garnet from bulk bags vertically, horizontally or any angle, over short or long distances, to the waterjet pressure pot location.

## Global 4IR experts for South African tradeshow

27 and 28 November 2019

Twenty-three presenters, including several European-based advanced manufacturing experts will address the impact of the Fourth Industrial Revolution on South Africa's manufacturing sectors at the African Advanced Manufacturing and Composites Show taking place on 27 and 28 November 2019.

The Show, which includes an exhibition, factory tour and Gala Advanced Manufacturing Innovation Awards and Banquet will take place at the iconic Nelson Mandela Bay Stadium in Port Elizabeth with the support of the DTI and Mandela Bay Development Agency.

Six workshops over two days will address the impact of 4IR on the automotive, maritime and general manufacturing sectors and focus on the rise and applicability of composites and advanced materials and manufacturing technology and process.

The international line-up includes Grafton LSR Ltd Engineering Director Mark Chapman, whose team has engineered the Bloodhound – the most advanced straight-line racing car ever built – to attempt to set a new world land speed record, which currently sits at 1227.985km/h.

Germany's Frank Henning of Fraunhofer, regarded as one of the world's foremost light-weighting authorities, Kjelt van Rijswijk CEO of Netherlands company



SAM|XL housed at Technical University Delft and JEC World International Sales Director Yohann Cailleau based in France, also add an international perspective to the event.

Co-ordinator Andy Radford of the Mandela Bay Composites Cluster said the speaker line-up is likely to include Toyota MD Andrew Kirby, the CSIR's Director for Advanced Manufacturing Martin Sanne, Jendamark CEO, Quinton Uren and Dr Anton du Plessis of the University of Stellenbosch, among others.

The Show injected cash flows of R42,8 million into the city's business community in its inaugural edition, and represents the largest gathering of Fourth Industrial Revolution role players in Southern Africa, with Nelson Mandela Bay retaining host status for the second edition in November this year.

The Show is hosted under the auspices of the DTI-supported, national Composites Cluster, in collaboration with government industry and academia.

Radford said the participation of over 3000 influential role players positioned the inaugural Show as Africa's premier Initiative in the field supporting the triple helix model of innovation which involves interaction between academia, industry and governments, to foster economic and social development.

Radford said plans announced by the AIDC EC to establish a globally interconnected Smart Industrial Academy in the province, attached to the prowess of global 4IR companies like Jendamark positioned the Eastern Cape as a suitable host for the 2019 edition.

"The Advanced Manufacturing sector is highly fragmented in South Africa. Many associations and industry bodies promote advanced manufacturing but generally there is a lack of integration and awareness of even our own capabilities, which are substantial," Radford said.

"Over 100 exhibitors showcasing three-dimensional printing, lasers, automation, virtual and augmented reality, artificial intelligence, drones and materials of the future are motivating tools to encourage a new generation of engineers and scientists but we need to expose them and industry to these technologies without wasting any more time," Radford said.

The Show includes the exhibition, workshops, tech demos, factory tour, a drone demonstration and the National Advanced Manufacturing Innovation Awards. □

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Our **Lawyers** who are **Engineers** and **Scientists** too understand your complex legal and regulatory matters which require an understanding of the technical subject matter and a firm grasp of the law.

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So ask yourself, should your **Lawyers** be **Engineers** and **Scientists** too?"

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