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MARCH 2017

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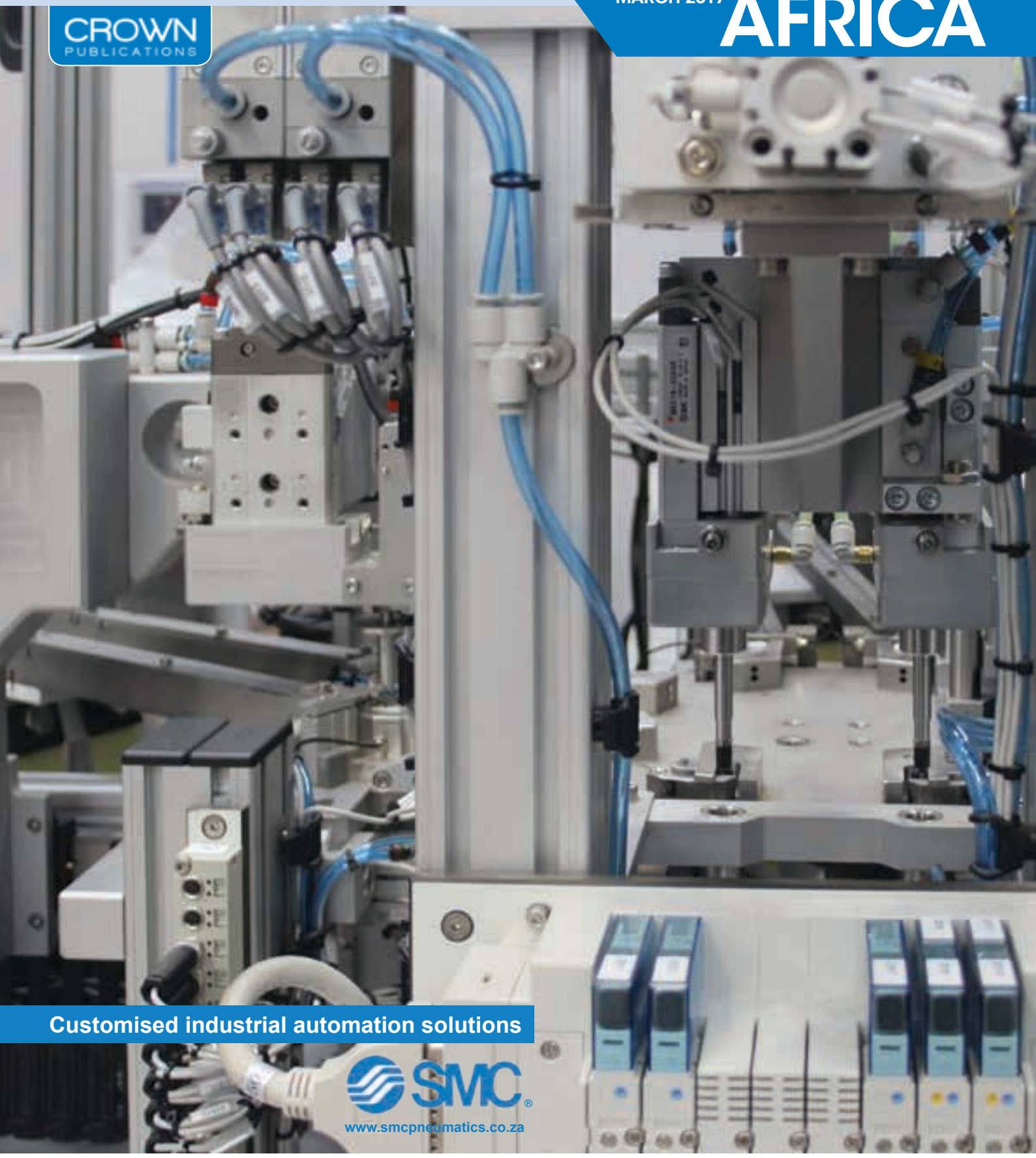

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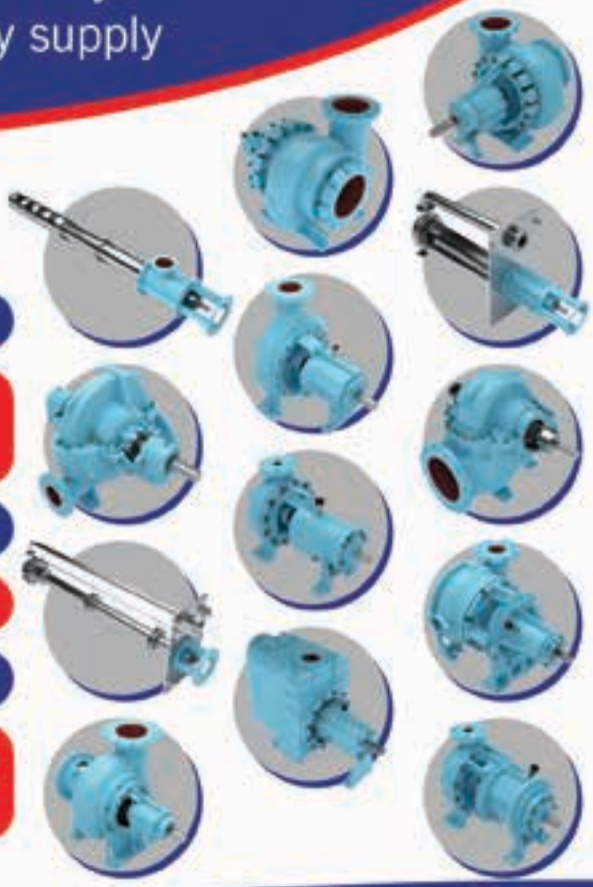

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PUMP SYSTEMS, PUMPS, VALVES AND SEALS

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SUSTAINABLE ENERGY AND ENERGY MANAGEMENT

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INNOVATIVE ENGINEERING

REGULARS

An alternative to matriculation

COMMENT

Peter Middleton

I have a 17-year old daughter in grade 12 right now, being prepared to write her 'matric' exam, amid unbelievable amounts of pressure. As well as the continual weekly cycle of tests, essays, projects and exams, her after school timetable is blocked with extra work: Master Maths for two two-hour sessions per week; extra IT for an afternoon session once a week; and advanced programme (AP) English, also for two two-hours sessions, with the second timetabled from 4:30 to 6:30 every Friday afternoon.

She is not often home from school before 5:00 pm and twice a week, she arrives after dark. I don't remember working nearly as hard in my final year at school.

Matric is now a colloquial term unique to South Africa. It was the original university entrance examination. My daughter is writing her National Senior Certificate examinations. For her and her peers, though, university entrance is still the focus. All are anxiously striving for the grades required for entry into their chosen university courses.

Yet by far the majority of students taking the 'matric' exam this year, including many of those at the best schools, will not follow the academic university route. And in the case of engineering, far less than half the students who meet the requirements and enrol at universities will graduate with degrees.

The early exit points from the traditional South African school system are mostly 'failure points'. There are numerous examples of people applying for jobs with a Standard 6 or a Grade 10 school leavers' certificate, from which we infer that the candidate has 'dropped out' somewhere along the common path towards matric. Anybody not going through the Grade 12 end-point successfully has 'failed' in some way.

In the UK and associated Commonwealth countries, the education system's first exit point is the General Certificate of Secondary Education (GCSE). A two-year GCSE programme is taken by learners in Year 9 and 10 of their schooling and is designed to accommodate the full range of abilities. While it is not compulsory to sit the exam, all children under the age of 16 must attend school and, since learners are very seldom held back, almost all 16-year-olds reach this exit point at the same time.

After completing GCSEs, education pathways branch in several directions: towards school- and college-based vocational programmes, (NVQs); into traditional academic programmes targeting university entry requirements (A-Levels); to skills-based training courses in traditional and modern trades; and into direct employment. Simply put, most UK youngsters choose their career path at 16.

Back in South Africa, there have been repeated attempts to establish and promote technical and vocational career pathways through the technical high schools, Further Education and Training (FET) colleges and the more recently named Technical and Vocational Education and Training (TVET) colleges.

In producing *African Fusion* this month, I was heartened to hear from the SAIW's Etienne Nell about a renewed commitment, particularly from Deputy Minister Manana of the Department of Higher Education and Training (DHET), with regard to the TVETs. Manana's plan is for the TVET colleges to be the primary vehicle for the delivery of trade tests in South Africa.

The implications of this are notable. First it indicates recognition of the need for higher-level skills in South Africa. It also recognises that, for our youth to reach international skills standards, training need to start at a much earlier age – learners can enrol at a TVET college at 16.

The idea is that artisan training is administered through the DHET; follows a curriculum based on the new Curriculum Quality Council for Trades and Occupations (QCTO); and has as its end point, a Trade Test under the supervision of the National Artisan Moderation Body (NAMB). Here we have the makings of an alternative exit point from the education system, one that could result in school leavers walking directly into useful and well paid employment while still in their teens.

Nell, who has been part of a group working towards establishing the QCTO curriculum for welding for several years, says that the new QCTO welding curriculum meets the Bratislava International agreement for welder training signed by about 50 countries across the world. "So if a South African welder passes the new QTCO-based trade test, he or she can secure a job anywhere in the world. That is what is so excellent about this new curriculum," he says.

This means that a young learner exiting a TVET college having passed a trade test could end up more employable, nationally and internationally, than a high-achieving matriculant. ❑

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SMC's exponential expansion plans

SMC Pneumatics celebrates its second year in South Africa this April. *MechChem Africa* talks to the pneumatics and automation specialist's general manager, Adrian Buddingh, about the company's growth path and 2017 plans.

Having officially opened in South Africa in April 2015, SMC Pneumatics moved into its state-of-the-art Growthpoint premises in Midrand in November 2015, enabling the company to receive stock and begin trading. "When we opened nearly two years ago we estimated that SMC's market share in South Africa was at around 2.5%. But SMC has 32% of the global pneumatics market and a footprint in 83 countries, making it the largest pneumatics company in the world," says Buddingh.

"In April 2016 we hosted our official grand opening, so we have nearly completed our first full year of official trading. From the 2.5% market share this time last year, we feel that we are now on target to achieve our market share vision by the year 2020," Buddingh assures, adding, "we see this as a good indication that demand is there and growth potential is realistic."

During this first full year, the local customisation facility was accredited by the company's Japanese parent and spear-headed by head of manufacturing from SMC UK and long-time employee of the company, Peter Austin, to ensure that SMC South Africa aligns to stringent global standards. Austin will spend the next few years in South Africa heading up the local production team. "We have also been systematically increasing our staff complement, a few of whom are relatively new to SMC's product offering and internal processes. We have, therefore, been focusing on internal training conducted by both local team members and international colleagues from various parts of the world. The support that we have internationally is phenomenal and ensures that we are on-par with global trends and international standards," he tells *MechChem Africa*.

"Locally, we believe that we have found the right skills to accompany us on this journey and we now focus on our sales team members with the specific expertise to open up new avenues whilst being backed by an experienced team of office staff," he says.

"Within SMC, we take a planned approach to each financial year. We determine the demand and the potential in the industry, and fill positions based on careful calculations and the right people for the job," he reveals.

Starting with two people at its initial launch, SMC had employed 27 people by the end of February 2016. "People-wise we are also on track, having grown our staff to 64 people during this financial year.

"The five-year plan is to achieve significant market share by 2020, which initially means we have to grow exponentially," Buddingh explains.

Lean manufacturing

The manufacturing facility is now fully operational and quality-accredited for the licensed set-up of components that can be locally manufactured and assembled. The facility has three actuator assembly lines; a fourth line for the assembly of valve manifolds and FRLs (filter, regulator, lubricators); and a fifth for adding accessories to existing products.

"We are licensed to manufacture a key set of products here, but, should the demand emerge, we are able to expand the number of products we can make locally. The capacity is in place for the long term, so we anticipate exponential growth in this offering, as well," Buddingh says.

The latest addition to the locally manufactured product offering is the large bore CS1 cylinder range, which includes bore sizes of up to 300 mm in diameter. "These cylinders are ideal for use in the mining industry," says Buddingh.

In addition to local component manufacturing, SMC is adding a panel assembly facility to its Midrand factory. "Control panels are almost always required for pneumatic automation systems, so we are adding panel assembly to our production offering. At the starting point, we will offer pneumatic circuit and panel design services.

"We will then have the panels locally manufactured, before populating them, typically with the required valve terminal blocks, pre-piped and wired to the chosen controllers, PLCs, electric drives and interfaces."

Customisation is an inherent concept underpinning the use of valve terminal blocks, which enable custom-designed solutions to uniquely suit applications and plant layouts. "Control panel design and assembly enables us to offer holistic customised solutions based around basic pneumatic components such as valve terminals, air service units and controllers. The idea is to start small and simple, but ultimately to expand in terms of sophistication and scale so as to offer complete automation solutions," Buddingh informs *MechChem Africa*.

"What we are doing now, though, is to put in the infrastructure to support this. We have employed a designer, Ingrid Horner, who will put the panel designs together in CAD and she has now been trained overseas in the use of SMC systems," he adds.

Once panel production is on the floor, which should happen before the end of the third quarter of 2017, SMC SA's customised

Above: A pneumatic clamping system used in an automotive assembly plant. In South Africa SMC's biggest market is for the Car Project (CP) range, which includes automotive solutions for passenger and commercial vehicle production.

Left: Ultimately, SMC South Africa hopes to expand in terms of sophistication and scale so as to offer complete automation solutions.

Control panel design and assembly enables SMC to offer holistic customised solutions based around valve terminals, air service units and controllers.

The latest addition to the locally manufactured product offering is the large bore CS1 cylinder range, which includes bore sizes of up to 300 mm in diameter.

production plans will have been completed. All of the Japanese approvals are in place and each line includes quality control and testing measures as well as unique recording and traceability labelling.

Specialty products

As well as being able to offer the widest range of premium quality pneumatics and automation components, SMC has some niche and uniquely different peripheral products that, to date, have been unavailable in South Africa. "We have an interesting range of air handling products, such as ionisers; air dryers and chillers, which are often needed in environments where pneumatics is used," Buddingh explains.

In the packaging industry, for example, static is a common problem. Plastic wrap, foam packing or labels cling and attract dust, causing misapplication or contamination. SMC offers bar, fan and nozzle ionisers, as well as static detection sensors that, together, can monitor and minimise the effects of static electricity.

"We also offer air dryers and chillers that enable the air quality in critical manufacturing environments, such as those in the food, beverage and pharmaceutical industries, to be accurately regulated.

"Increasingly, we find it is these products that initially attract customers. And once people see the service levels we are able to offer through our unique peripherals, it is a small step to becoming a preferred supplier for regular components," he says.

Target markets

"Worldwide, the food, beverage and packaging industries are our biggest markets. In South Africa, though, our biggest is SMC's Car Project (CP) range, which includes automotive solutions for passenger and commercial vehicle production.

"Automotive is very healthy for us at the moment. SMC Germany has secured large projects in South Africa to large automotive manufacturers. We have good historical relationships with the likes of Toyota, and Nissan. There are also opportunities from Tier 1 suppliers to the automotive industry, such as the rubber manufacturers, which we have dealings with on an ongoing basis.

"This has all led to a realignment in our thinking about distribution centres (DCs). We now intend to accelerate the establishment of a DC in Durban, not just for the automotive sector, but for general industry there too. Cape Town and Port Elizabeth should open shortly thereafter," Buddingh notes.

Market growth? "Automation is topical right now, so over the next five years, we expect GDP to be at around 2.0%, while automaton growth will be a little ahead of that at 3.0%. The nice thing about our new business is that we have a mixed application range, so when one area of industry is down, we can pick up elsewhere," Buddingh concludes. ❑



An interview with Maloba Tshehla

This month SAIChE's Michelle Low speaks to Maloba G Tshehla, who has a Bachelor of Science in chemical engineering and a Masters degree in sustainable development from the University of Cape Town and Stellenbosch respectively. Tshehla works as a renewable energy sector manager at Green Cape.

ML: Tell us about yourself.
Hi Michelle, thank you for this awesome opportunity. So a little bit about myself. I am a Mosotho national and have grown up in various parts of this region – namely, Durban – for three years in my pre-teen years, and then in three different neighbourhoods in the Maseru district of Lesotho. I like to think this has enabled me to quickly and easily make friends, remain open minded and not fixed to one single place. We are all citizens of this world.

As a result of this global citizenship, I developed a passion for climate change mitigation at a very young age (midway through my high school years), which lead to a decision to pursue chemical engineering studies – the ultimate aim having been to make clean petrol – and then later a Masters in Sustainable Development with a focus on renewable energy. This, to me, is a well-aligned purpose for me, while cleaner petrol and more efficient engines are equally important in the transition to a sustainable economy.

This passion also extends to wellness, fitness and overall health, a lifestyle that I live and share my journey with others, in the hope of encouraging and assisting them on their own personal journeys. A healthy body, a healthy mind, a healthy person, a healthy society, a better world to live in.

In the renewable energy space, GreenCape strives to inform investors of changes and developments within South Africa's utility scale renewable energy sector. It highlights the composition of the market, discusses key players, market size and noteworthy trends, and then covers the main guiding policies and legislation in the renewable energy space, before exploring opportunities, incentives and barriers within the sector. Depicted above is the Darling Wind Farm in the Western Cape.

ML: What do you do at GreenCape?
At Green Cape, I work as a renewable energy and energy services sector expert. My role is to manage our relationships with member companies and individuals in the renewable energy and energy services – energy efficiency and embedded generation – value chains.

This entails hosting networking events to create platforms for information sharing and clarification on pertinent industry issues, understanding and relaying this understanding of policies to companies within the value chain, as well as relaying industry concerns to government.

The ultimate aim of this work, and of GreenCape's existence is to see more investments into projects within renewable energy, energy services and the wider green economy – especially investments that lead to manufacturing activities which create much needed jobs.

ML: Why the energy and sustainability sector?
Energy is central to development and if we are to go on a more sustainable development pathway, it is imperative that our sources of energy and how we interact with energy is more sustainable. South Africa has one of the world's most energy-intensive economies as well as most carbon intensive energy mix

(and therefore economy) and so it is a national commitment and responsibility to change the country's energy mix. This is important to me.

Beyond this, looking into the development of Africa as a whole, energy access is needed not only as 'development', but as a means of access to participation in the economy and as a way of power access to information – which is everything!

ML: What is one inspiring quote that you live by?

'Keep On Keeping On'. This is the underlying ethos of my being. From sports to work to relationships. The distance between my present and my goals and ambitions is consistent, persistence, dedicated work, and so I must keep on keeping on. With no excuses.

ML: How has your chemical engineering qualification helped you get to where you are today?

The biggest benefit from chemical engineering – apart from finishing design and a mini thesis and feeling like after that, there is little else I cannot conquer, has definitely been the ability to break down problems, analysis and solve logically, almost from first principles. Elements of process thinking always come in handy when attempting to solve problems, both long term, institutional issues, and shorter term, project specific issues.

ML: Any advice for students and colleagues?

Listen to your heart and mind, find that which you are passionate about and that which fulfils you. Do not shy away from doing the required work to turn that passion into a career that you are proud of, that adds value to society and that feeds your soul.

We all have our part to play, and as engineers, part of our calling is to be excellent at what we do and embody the ethos of diligence, precision, persistence and excellence.

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Instagram: @level10bear

Gauteng Members Group News

In 2016, the SAIChE IChemE Gauteng Members Group awarded prizes at the University of the Witwatersrand School of Chemical and Metallurgical Engineering Final Year Oral Presentation Day. The winners were based on the highest marks averaged from both internal and external examiners, and the two groups that won were tied for the highest marks.

The prizes that were awarded were the "Best Final Year Chemical Engineering Oral Presentation". The prizes were presented to the students by Associate Professor Michael Daramola (pictured), at Wits University, and a committee member of the SAIChE IChemE Gauteng Members group. Congratulations to all of the students!

Thank you note

SAIChE IChemE Gauteng Members group would like to thank those who attended the event on Wednesday 15 February 2017, titled "The culture of safety in a process-driven world". The talk was given by IChemE Safety Centre's director Trish Kerin and we thank her for her time spent imparting her safety knowledge. Our members who had attended will earn 0.2 CPD points. Be safe!

Michelle Kange and Godfrey Mawire.

Eric Mpholhoni and Ntuthuko Zwane.

SAIChE IChemE

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SAIChE training course diary

Layer of Protection Analysis (LOPA)

24-25 October, Boksburg, South Africa

Covers the methodology of LOPA and the detailed stages of its application. Delegates are shown how to identify significant scenarios, estimate frequencies for worst-case events and assign risk categories while learning how to lead a LOPA study.

Fundamentals of Process Safety Management

6-10 November, Boksburg, South Africa

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Specialist alloys and custom

SAM Engineering, the manufacturer of SAMCO pumps in South Africa, delivers a variety of chemical and corrosion-resistant pumps that are custom-made to suit the harsh conditions of the minerals processing, mining and petrochemical industries as well as the demands of process applications involving, food, chemicals, pulp and paper and fertiliser. *MechChem Africa* talks to Danny Lubbe, the company's sales manager.

SAM Engineering's history dates back to the 1970s, to a company called Sandock Austral, which had the license to locally manufacture Allis Chalmers pumps. "But in the 70s, Sandock Austral withdrew from South Africa, leading to a buy-out by the local manufacturing director, who bought the casting patterns and secured the rights to continue to manufacture the pumps here in South Africa," Lubbe begins.

"When ITT purchased Allis Chalmers, the licensing agreement was extended, but ITT soon acquired the Gould pumps brand instead, leaving the Allis Chalmers installed base across Africa unsupported. So the SAMCO pump brand was born," he relates.

Over the years, notable changes were made to suit the harsh local requirements. "We added wear plates to the designs, for example, so that the pumps could be refurbished more often and more economically, giving them a longer life and reducing the ownership costs," he explains.

Most notably, though, the SAM Engineering name is an acronym of 'Specialist Alloy Manufacturer', which reflects a deliberate strategy to be as flexible as possible when it comes to alloy choices and material combination for the SAMCO pump range.

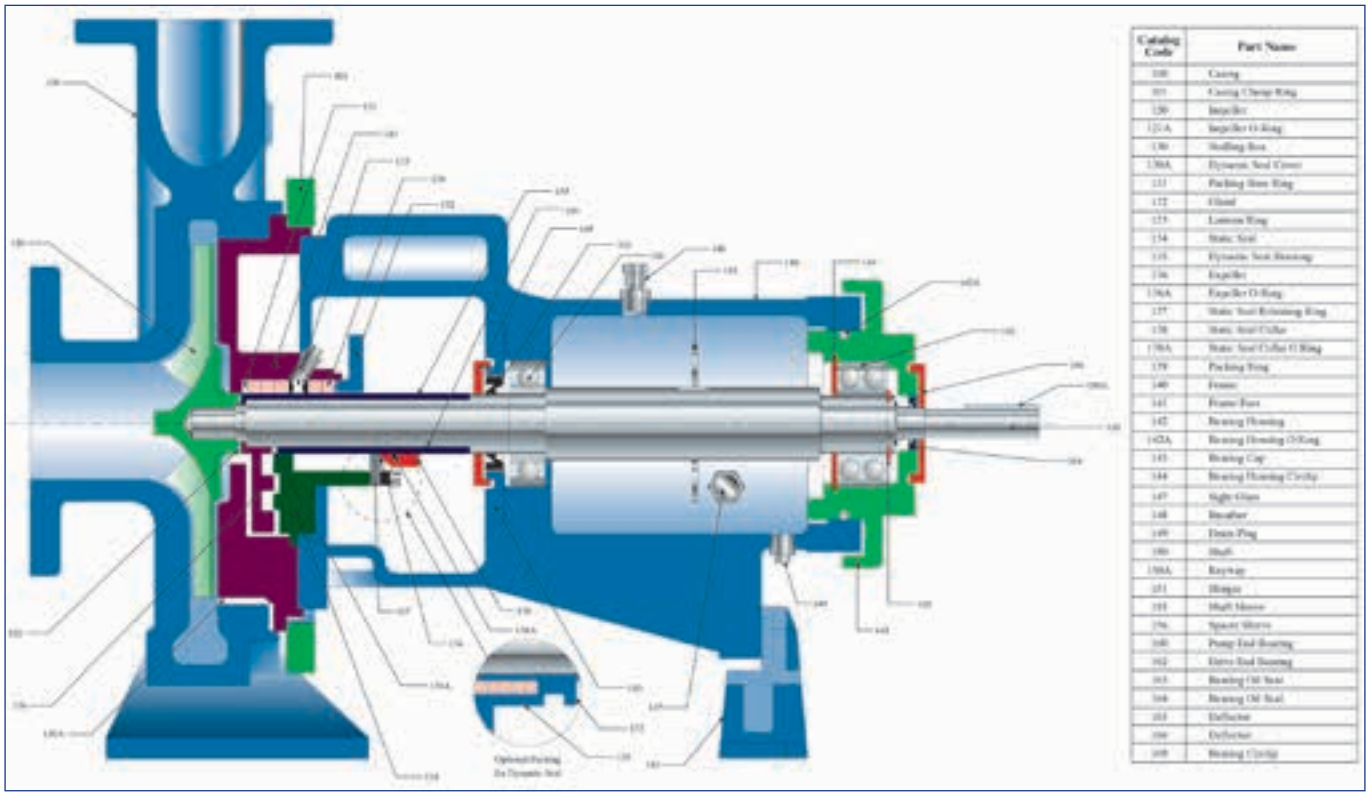
"Our motto is 'customised pump solutions' and we live up to that motto by manufacturing our impellers, volutes, wear plates and bearing frames in the material or alloy that best suits the actual application," Lubbe notes, adding: "We can offer any combination of 11 standard alloys and we have complete flexibility with respect to novel materials of manufacture.

"We were the first company to agree to manufacture skids, bearing frames and the power-end of our pumps from stainless steel. This is a big no-no from global OEMs, which all tend to standardise on their frame materials. Very few will agree to custom manufacturing," Lubbe suggests.

"Up in places such as the Copper Belt, the conditions are often terribly harsh and pumps fail regularly. By supplying stainless steel frames and customised wet-end alloys, our pumps are far better protected, so they last longer and are more reliable," he explains.

"Our wet-ends are manufactured in all kinds of materials: CD-4 wear plates, a wear- and corrosion-resistant duplex alloy; impellers and volutes from materials such as 316, duplex and super duplex stainless steels; or Alloy 20, a nickel-chromium-molybdenum alloy that is ideal for sulphuric acid applications. We strive to offer the highest corrosion resistance possible for the media being pumped," Lubbe advises.

Long serving SAM Engineering clients include customers such as Tongaat on the food side and SAPPI, for pulp and paper. "For pumping pulp and liquids with solid content, we use open impellers. These have no shrouds on the inlet side so that solids can be easily discharged without clogging the pump," Lubbe tells *MechChem Africa*.



SAMCO CP and CPO chemical process pumps are "our stock in trade". SAM Engineering can manufacture these in 34 different model sizes with 11 different material combinations.

pumping solutions

Above: *One of a batch of SAMCO HM 316 stainless steel pumps awaiting delivery. Originally developed for light slurries, these pumps have also been adapted for use in chemical process applications.*

Above right: *A SAMCO pump in the final stages of assembly in the company's Boksburg premises.*

Right: *Components such as impellers, volutes, wear plates and bearing frames are all locally manufactured in the material or alloy that best suits the actual application.*

Stainless costs? "In comparison to operating costs, the capital costs of pumps on these plants are relatively small. So they are often seen as consumable items. Our pumps offer much better uptime and longer life, so they cost the plant much less over time.

"We can also reuse a stainless bearing frame and volute casing several times over. We use a spacer coupling between the pump and the motor. Once the coupling is removed, the pump shaft, impeller, seals and wear plates can be pulled out without affecting the motor alignment. The bearings, seals, impeller, wear plates and bushes can then be replaced before refitting and re-coupling the refurbished pump to the motor," he says adding: "this is known in the industry as a 'back pull-out design'.

"So if a pump needs a refurbishment in Northern Zambia or the DRC, for example, we can simply send up the appropriate SAMCO wet-end kit and the local pump fitters can do the rest," he says.

"Over the past 30 years, SAM Engineering has sold over 20 000 pump units into industry and our current SAMCO range comprises 13 different models, 137 different sizes in 11 different iron, steel and alloy material combinations," Lubbe notes.

SAMCO Pumps can produce up to 5 000 m^3/h of flow and maximum heads of up to 200 m and the biggest the company has ever manufactured is driven by an 800 kW motor.

"All our pumps are made to order. Depending on the alloys chosen, we quote four to six week delivery times for readily available combinations, but this might stretch to 14 weeks if the materials, alloys and heat treatments are more difficult," he notes.

From a localisation perspective, all casting, machining, inspection, assembly and painting tasks are completed locally," Lubbe says.

Current successes? "Our stock in trade is process pumps for food processing, pulp and paper, minerals processing and fertiliser industries. But it is our business in the copper/cobalt processing industry north of our borders that is very strong at the moment," Lubbe responds.

"Acids are widely used in copper processing to reduce ores from the mines: in the solvent extraction plants; to break down the waste through the leaching process; and in the electro winning process itself, which produces the copper sheeting," he explains.

To improve the efficiency of the copper extraction process, the pregnant liquor solution is pumped from the heap leaching process to the solvents extraction and electrowinning plant, where copper cathodes are formed and the spent liquor is pumped back to the heap for further refining.

"Currently, this business is keeping us going – and the copper price indications are looking positive, so things are looking up for us," he says.

"Any pumps purchased from SAM Engineering or SAMCO Pumps, no matter which original brand name is on the name plate, can be serviced, refurbished or replaced with parts currently manufactured by SAM Engineering," Lubbe concludes. "Standardising on the SAMCO Pump brand avoids incompatibility issues and reduces the risks of spares or pump models becoming unsupported in the future." ❑

Pumping systems 101

Why throttle pumping systems?

UNIDO International Pump Expert, Harry Rosen, relates his experiences about throttling and makes compelling arguments for trimming impellers or installing VSDs instead.

When I first started TAS over 20 years ago, we specialised in developing pump selection software for the pump manufacturers. Over the years we developed various software modules that could handle anything from submersible, vertical line-shaft, multi-stage and positive displacement pumps through to the pumping of slurries and viscous fluids.

At that stage, I naively thought that if you selected the optimum pump for the application – taking into account the system requirements, type of fluid, etc – then the pump would operate efficiently and reliably over its lifetime and everyone would be happy. Little did I know.

The more involved I got with actual users of pumps, the more apparent it became that most pumps were not operating anywhere near their original design duty. This was due to a number of reasons going right back to when the system was designed.

Pumps are often selected very early in the design process when insufficient detailed information about the system is known – static heights, pipe materials, types of valves, etc. As in any case where assumptions have to be made by engineers, safety factors are added to the design. Plants are also designed with a view to increased throughput in the not-too-distant future; so maximum long-term flow requirements are used in the selection. Pipe friction losses increase exponentially with flow, so the pump's design head will increase rapidly when over specifying the flow requirements.

No consulting engineer wants to commission a plant where the pumps cannot satisfy the required duty. Rather overdesign than be caught short? Wrong!

If you were designing rolling stock for the railways or a bearing housing for a large mill, overdesign using safety factors will ensure a longer life for the components. In the case of pumps, however, overdesign or selecting the pump for a much higher flow/head requirement will reduce the reliability of the mechanical components over the life of the pump – as well as dramatically increase the energy required to pump the required fluid.

The traditional solution to the problem – a control valve to reduce the flow back to the original requirement – would have been acceptable in the distant past before Eskom load shedding and the increasingly expensive cost of electricity. Nowadays, throwing away energy through a control valve is no longer acceptable.

Traditional throttling

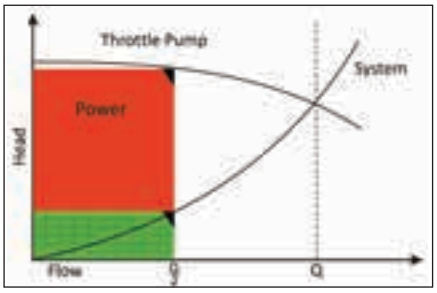
Here is a typical scenario from a paper mill with a requirement to pump final paper stock to a header box in the paper machine:

- The plant hopes to expand plant capacity in the next five years, when the flow might increase by 50%.
- The exact piping and configuration is not known so a safety factor of 10% is added to the head.
- The pump supplier selects a pump to give slightly more flow than required.
- When tested, the pump over performs on flow and head, but still within the test tolerance.

During on site commissioning, the pump is found to deliver twice the flow rate that is required. The solution? Throttle the pump using the gate valve as a control valve until the required flow is achieved.

I have hundreds of pictures from countless plants showing gate valves that are more than 70% closed, having been told that they have been like that for years.

A typical gate valve in the pulp and paper industry, clearly showing the valve is approximately 90% closed.



The energy implications of throttling pumps. When throttling, the red area shows wasted power while the green is useful fluid power.

If we look at the pump curve, the area under the curve represents the fluid power required (red and green blocks in the example shown). If we trimmed the impeller or reduced the speed of the pump, the actual power required is represented in green. The portion in red that is being wasted through the control (gate) valve amounts to more than 75% of the power absorbed by the pump.

What is the solution?

Trimming the impeller costs very little money and could be implemented immediately. A full size impeller could be then be kept in the store in case future demand escalates inline with the designer's expectations.

The cost of installing a VSD or downsizing the pump would be a more expensive solution, but it would still be easy to justify based on energy cost savings.

The cost of throttling

If there are gauges before and after the control valve, it is very easy to estimate the energy losses through the valve. Divide the pressure drop across the valve by the discharge pressure of the pump, and multiply by the motor rated power to get an estimate of the wasted kWs. Multiply by the number of hours the pump operates and the cost of power and you now know just how much money you are wasting by using a control valve.

More importantly, you now know how much money you have available – on a return-on-investment basis – to fix the problem! Table 1 demonstrates just how quickly these costs accumulate.

When I observe pumps being throttled and ask why, the answer often given by operators is that it is due to the maximum amps on the motor. This applies from rural pump stations next to a farmer's dam to high-tech plants where SCADA systems control every machine in the plant. Sometimes there is a red mark on the dial meter showing the maximum amps for the motor. In most cases the operator has been told something like "keep the amps below 70 A" and nobody questions why.

The value quoted by the operator or marked on the meter very often has no bearing on the actual maximum rated current the motor can handle. The maximum value specified on the motor nameplate is often higher, or on checking with the control room, nobody knows of any reason for the current to be kept below 70 A. "This is just the way it has always been done."

Maybe years ago they had a very hot summer and due to insufficient cooling, they de-rated the motor power for a specific period. There are generally no flow meters in pump stations, so the maximum current setting could have been related to a flow rate required for a specific duty. Or someone might

Pumps are often throttled to limit the current drawn by the pump motor. In many the original reason for doing this is forgotten and it is no longer necessary.

have just read the maximum value from the technical spec sheet incorrectly.

The solution? Open the valve and see if there are any adverse effects on the pump or motor. The energy savings can be quite stupendous.

In a parallel pumping case study for a steel mill cooling water system, for example, six pumps were operating in parallel, providing cooling water into a steel mill. All the pumps were throttled to between 25 and 50% open to ensure the current never went above 73 A, even though the rated current for the motors was found to be 85 A.

When opening the valve on one pump to 100%, we observed that the current never went higher than 79 A, well within the rated capacity. We were able to achieve the same flow rate (actually slightly higher) with only five pumps running. And shutting down one pump reduced the total power drawn by 258 kW.

Motor rating	110 kW
Pump discharge pressure	640 kPa
Pressure downstream of the valve	380 kPa
kW wasted	= (640-380)/640×110 = 44.7 kW
Energy wasted	= 44.7×8 760×0.9×R0.90/kWh = R317 000 per year

Table 1: A table showing how much energy and money is wasted by throttling a pump and how much money can be made available to fix the problem. A 90% utilisation factor is assumed.

These pumps have since been running in this state for over a year with no adverse effects on the motors, resulting in saving of over R1.5-million/year in electricity costs and 2 050 000 kWh per year in energy savings.

Identifying energy-saving opportunities from throttled pumps is actually easy. All that is needed is a stroll through the plant with your eyes open.

- Look for control valves with pressure gauges upstream and downstream of the valve and use the formulas outlined here to estimate the wastage through the valve.
- Look for ammeters showing pumps are drawing maximum amps – these pumps are, most likely, being throttled.
- Question every answer you get and never assume the original reasons are still valid.

If you discover that any pump is being throttled, the first question is, does it need to be? If it is only being done to limit the motor current, then it is often unnecessary. Open the valve and see what happens.

If there is a valid reason for throttling the pump, then two far better and more economical options are available to pump operators. The first is to trim the pump impeller. This will return the pump's operating point to the duty point of system, saving significant amounts of energy and money.

The second solution, which is slightly more expensive but still highly cost-effective, is to reduce the pump speed by using a variable speed drive (VSD).

There are no good reasons to continuously throttle pumps. Not only are you throwing electrical energy and money away, but also the reliability of the pumps always suffers if they are operated too far away from their duty points. ❑

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Real, round-the-clock rental pump availability

There are many companies in the pump rental business that promise, but not all of them deliver, according to Integrated Pump Rental managing director, Lee Vine. "Actually delivering a rental service all day, every day, to the standards that the customer needs, is the core of our business model," says Vine. He gives an example of what he means by this.

"When a customer is in dire need, experiencing a dewatering problem for instance, he needs a quick turnaround time with the right product available. This is what we do." Vine cites a recent case of a surface coalmine customer urgently needing to dewater a large section of the pit.

"The requirement was for the supply and installation of nine diesel pumps with 2 000 m of lay-flat hose, including fittings," he says. "The call came in at 2:00 pm on a Saturday; by the early hours of Sunday morning, the installation had been completed and our customer was more than satisfied."

He highlights the accessibility of equipment as key to the success of Integrated Pump Rental. The company maintains a comprehensive rental fleet covering all needs, with the requisite technical support for installing and commissioning on site as a vital part of the service and support offering.

The company provides turnkey pumping solutions for small, medium-sized and large projects, ensuring that each project is carefully assessed to ensure the appropriate response.

"While we do have off-the-shelf options available for rent, our approach is to understand the customer's needs and then recommend a fit-for-purpose solution," says Vine. "It is not a case of one-pump-fits-all when it comes to the type of pumping environment in which we operate."

Integrated Pump Rental's fleet includes submersible drainage and dewatering pumps, slurry and sludge pumps, diesel-driven pumps, dredging units, flotation devices and accessories. All pump rental solutions available from Integrated Pump Rental are ISO 9001 certified.

The locally manufactured SlurrySucker Dredge units, for example, are ideal for dredging and cleaning water capture areas where silt or slimes are encountered, while the SlurryBlaster hydro-mining equipment offers optimum performance coupled with reliability.

Effective groundwater control and the Sykes range

A recent addition to the rental range is the Sykes diesel-driven pump, suitable for all applications where electrical power is not available; these reliable pumps are engineered to offer market-leading efficiency and are extremely robust.

Integrated Pump Rental provides turnkey pumping solutions for small, medium-sized and large projects.

Vine says that Integrated Pump Rental secured the agency for Sykes for southern Africa and all Sykes products are available for either sale or rental. This includes diesel and electric driven self-priming units.

Unless there is effective groundwater control, even the best run sites could become hindered by expensive and challenging problems. This will not only cause programme delays but could also have an adverse effect on health and safety.

Boasting one of the best shaft stiffness ratios of any automatic priming pump on the market, the Sykes high head range provides the reliability to meet market expectations.

Vine cautions the market that dealing with dewatering activities is not as simple as merely purchasing or renting a pump.

"It is essential that contractors deal with a supplier that understands dewatering applications and is able to provide the correct level of technical assistance as this will ensure that the most efficient method of dewatering is selected for a specific site," he says.

Integrated Pump Rental is responsible for marketing the Sykes range of dewatering pumps in southern Africa. Vine says these pumps have an established reputation for the fast and effective control and removal of sub-surface water.

The most typical application of Sykes dewatering pump technology is on building and construction sites, civil engineering projects, local municipality works, flood disaster recovery, load-out stabilisation, slurry transfer, ash handling, and water. Sykes pumps are designed to offer robust and reliable performance and can handle high volumes of water with ease.

The Sykes Primax Contractors Range of diesel driven pumps offers the market reliable dewatering coupled with cost efficiency. These are fully automatic priming pumps and can run dry for extended periods due to the oil bath mechanical seal assembly. This allows priming with long suction hoses and suction lifts of up to 9 m. Constructed using quality materials, the pumps are fitted with a 316 SS impeller and wear plates as standard. The pumps are capable of handling solids up to 90 mm.

Pump and hose flotation devices and custom-engineered automation systems are also available for all pumping applications. Industries across Africa served by Integrated Pump Rental include mining, quarrying, construction, wastewater and energy. ❑

Crowning a successful year

According to KSB Pumps and Valves' slurry specialists, Mohamed Trabelsi and Rob Bond, the ability of the company to supply a full range of high quality pumps with full backup and support, as well as readily available spare parts, has placed the company in a unique position where mines can meet all their pumping requirements through a single supplier.

Local pump supplier, KSB Pumps and Valves, has continued its strong gains in the mining sector with several large-scale slurry-pump contracts being awarded to the company in the latter half of last year. These include projects in the ferrochrome, gold and copper industries as well as pumps to be used for stainless steel processing. In all instances the customers selected KSB pumps due to their performance and reliability, as well as the after sales service offered by the company, which is designed to ensure uninterrupted production in these high-value plants.

"This has put us in a position to supply pumps for several projects being undertaken by Minprotech, a company which processes downstream products from Samancor ferrochrome mines in Steelepoort, Rustenburg, Mooinooi and Milsaai, for example," says Bond.

"These projects are currently underway in phases and require the supply of a variety of slurry process pumps and water pumps. In this instance our slurry pumps were found to be best suited for the project and our already well-proven water pumps perfectly complement the company's requirements.

"Significantly, this international client also found that KSB Pumps and Valves globally had the best after sales support for such complex and demanding high production work," he says.

"Another large scale project that we have been awarded is the tailings expansion project being undertaken by QKR Mining Company, at its Navachab Gold Mine in Namibia. This calls for the supply of two trains of six LSA high-pressure (severe duty) slurry pumps in the discharge segment of the plant's grinding circuit," Bond continues.

"The two trains are designed for redundancy to ensure that pumping capacity is always available even in the event of a pump failure. Also, considering the severe nature of pumped materials and high pressures involved, the second train allows regular maintenance without affecting production.

"In this project the supervision and expertise of the company's Namibian branch manager, Klaus Streit ensures that despite the relative remoteness of the plant the mine has full-time access to KSB expertise," he assures.

Trabelsi explains that mines value the expertise of a globally connected company such as KSB Pumps and Valves, where engineered solutions can be found to ensure the right materials, types and sizes of pumps are used to reduce downtime and wear parts for the pumps. "That means that if the company makes the right selection it will get the best production and longevity from their equipment.

Rob Bond (left) and Mohamed Trabelsi of KSB Pumps and Valves.

"This is proving to be the case at Columbus Stainless in Middleburg, where the previous solution supplied by another company was proving problematic because of excessively high numbers of breakdowns and abnormally high wear on exposed parts. Also, aftermarket service was lacking and no solution was ever found by the previous supplier to remedy the situation.

"In this case we carefully analysed the requirements versus the materials being pumped, as well as the volumes required, and specially designed a pump solution based on our standard large-size 250 mm LCV heavy duty vertical pump. The application to remove steel scaling called for a pump with high wear resistance and the ability to operate in harsh conditions at high temperatures.

"We were able to meet and exceed these requirements and, needless to say, this particular pumping circuit on our customer's plant is no longer problematic," he says.

"Our growing reputation for expertise and quality has also given us the opportunity to supply the Australian firm, First Quantum, with a trial MDX 550 mill circuit pump for its Kansanshi Copper Mine," Trabelsi continues.

"This pump will primarily supply the cyclone feed for the secondary mill, where it will be the most critical production pump on the plant requiring a constant supply of course ore material to be delivered directly to the mill. This is one of the newer pumps that is receiving a lot of attention locally and abroad so we are confident that its performance will meet the company's strict requirements," he concludes. ❑

KSB Pumps and Valves' MDX 750c. MDX extra-heavy mill duty pumps are the heart of mill circuits, tackling the most extreme duty conditions.

Efficient motorised actuator for globe and diaphragm valves

GEMÜ already boasts a long-established selection of corresponding products in the areas of linear and quarter turn actuators for globe and diaphragm valves, butterfly valves and ball valves. Designed on the basis of the hollow shaft principle in conjunction with technology that does not use brushes or sensors, the GEMÜ eSyDrive sets new standards in terms of compact design, reliability and accuracy.

The new GEMÜ eSyDrive motorised actuator sets new standards in the areas of compact design, speed and accuracy.

GEMÜ has designed its new actuator in response to increasing requirements in the area of motorised valves, while recognising the current trend in the area of process automation. Pneumatically operated valves are increasingly being replaced with electrical versions.

The self-locking actuator offers a high level of reproducibility for positioning and is therefore particularly suitable for use in precise control applications. The Ethernet-based eSy-web interface, in conjunction with an integrated web server, enables the exchange of parameterisation and diagnostics data and the networking of several devices.

After starting initialisation, the actuator automatically adjusts itself to the current process valve, enabling the user to carry out commissioning quickly and easily. If necessary, the user can also make adjustments to the integrated stroke limiter as well as the respective end positions. The power supply for the GEMÜ eSyDrive is ensured via a 24 Vdc connection.

Depending on the size, the actuator has an actuating speed of between 2.0 mm/s and 6.0 mm/s. A mechanical position indicator and an electrical status and position indicator are integrated as standard. The GEMÜ eSyDrive also features a manual override as standard. A suitable emergency power supply module is optionally available.

Motorised valves are primarily used in areas where the use of compressed air is not desired or possible. Large-scale production plants are cited as examples of such areas, as distribution of compressed air is uneconomical in such facilities. Another example of the areas of use of these valves is mobile or decentralised facilities for drinking water treatment.

The GEMÜ eSyDrive is a linear actuator suitable for open/close and control applications. It can be used both in sterile applications in the pharmaceutical and food industries and in industrial processes. With its hygienic design and robust construction, featuring a protection class of IP 65, this new actuator is highly versatile.

The product range will be developed to successively cover use in globe and diaphragm valves with a nominal size of between DN 6 and DN 150.

GEMÜ is one of the world's leading manufacturers of valves, measurement and control systems. Over the course of more than 50 years, this independent family owned business has established itself in important industrial sectors thanks to its innovative products and customised solutions for process media control. ❑

Further information can be found at www.gemu-group.com

Niche pump for brewery and beverage sectors

The Netherlands-based Verder Group acquired the UK-based Fullwood Packo Group in 2015, with Verder South Africa embarking on an extensive marketing campaign for the food and beverage industry late last year.

Kobus Fourie, Packo pump specialist at Verder South Africa, explains that the range has application in 11 niche sectors. These are dairy, meat and fish, textiles, wastewater and potable water, breweries and distilleries, food and beverage, washing and disinfection, surface treatment, vegetables, animal feeds and biogas, hot frying oil, petrochemicals and pharmaceuticals.

"At the moment our campaign is focused on breweries and beverage plants and we are targeting additional sectors this year," Fourie confirms. Verder Packo pumps are available in capacities of up to 40 m^3/hour, with the latest addition to the range capable of 1 200 m^3/hour. This particular pump weighs only 1.6 t, with a 250 kW motor.

In existence for 230 years, Packo was the first company to design a food-grade pump. Its extensive experience has allowed it to eliminate typical problems and issues that smaller companies are only beginning to grapple with now.

Some of the innovations introduced by Packo include an electro-polishing process for all internal components. This results in a mirror-like finish that helps to combat bacteria build-up. Another feature is optional heating jackets for materials such as chocolate, creams and fats, which all need to remain liquid, even if the production process is interrupted.

Packo pumps also boast a monobloc design for ease of maintenance and durability. This also removes the need for a fixed base plate, which in turn limits the vibration produced. "The affordability of these products, in addition to the quality of the range, is making a major impression on the local food and beverage sector at present," Fourie says. ❑

Pumping technology for lubricants and abrasive fluids

BMG's extensive range of components for fluid technology systems and general industrial applications includes valves, hydraulic hoses and fittings, accumulators, cylinders, heat exchangers, hydraulic motors and hydraulic plumbing, as well as pumps and reservoir accessories.

*Above: Pumprite pneumatic high-pressure solvent pumps are ideal for heavy duty cleaning and maintenance in industrial applications and where hygiene is critical. **Left:** The Pumprite pneumatic grease pump, used to pump grease from grease drums of any size. **Below:** This complete pneumatic grease dispensing roller cart is used to easily transport, dispense and safeguard the grease drum. It comes complete with a Z-swivel and grease control nozzle.*

BMG's Pumprite range, which forms part of BMG's fluid technology portfolio, encompasses lubrication, grease, oil and abrasive fluid handling equipment, designed and manufactured locally to cope efficiently in Africa's arduous operating conditions.

"BMG's strategy to enhance its fluid technology services to meet growing market demand in diverse industries, incorporates the introduction of new products, with the latest developments in design technologies, materials and coatings," says Weylin Kapp, national product manager, lubrication, BMG. "The company's expansion programme in the fluid technology sector also involves increasing product stockholdings through more than 160 BMG branches and a wide distribution network in South Africa and across borders into Swaziland, Zambia, Botswana, Mozambique, Namibia and Tanzania.

"The Pumprite portfolio (which includes a wide range of pneumatic and manual pumping and transfer solutions for grease, oil, grout and abrasive fluids) is supported by a one-year manufacturing warranty.

"BMG's dependable technical support service ensures optimum safety, efficiency and extended service life of every system, even in corrosive environments. With broad technical capabilities, the team is able to solve problems, in applications where conventional components have failed after short periods of service. BMG's fluid technology services also cover project engineering and consulting, cylinder design and manufacture, training, repair and testing, as well as onsite container services."

Pumprite equipment – a key brand in BMG's portfolio – has been designed for use in diverse applications, including the transfer of product, lubrication of machinery, greasing, pack setting, rock grouting, washing, fixed systems, mobile systems and drag lines.

Pumprite pneumatic and manual pumps handle a wide range of products that include grease, oil, chemicals, grout and cement, air, water, petroleum, antifreeze, hydraulic oils, diesel fuel and detergents.

BMG's Pumprite grease range encompasses pneumatic grease transfer pumps, heavy-duty retractable hose reels, spring feed lubricators, foot-operated grease pumps, bearing packers and hand lever grease guns.

The pneumatic abrasive pump range handles cementitious products and wash/solvent pumps efficiently handle all water based fluids, as well as chemicals, acids, solvents and anti-freeze.

Components are manufactured from high-grade material, such as LM25 aluminium and EN8 mild steel. Crucial parts are heat treated with a ground finish for protection against wear, even in demanding environments. Air motors are anodised for extended service life and robust LLDPE accessories, including drum covers, are corrosion resistant. ❑

Heavy-duty retractable reels are used for high performance transfer of lubricants and abrasive fluids.

New Curve slurry pumps

Pump and Abrasion Technologies have developed a new Curve™ slurry pump, which, according to managing director, Jaco Buitendag, "is the first step towards our goal of becoming a first choice provider of slurry pump solutions across Africa".

The Curve S Model from Pump and Abrasion Technologies.

"With our newly launched Curve™ range of slurry pumps, Pump and Abrasion Technologies (PAT) has proved that we possess the know-how and the infrastructure to deliver first class slurry solutions and excellent service," says Buitendag.

"One of our main goals in developing the Curve™ was to offer customer-tailored solutions. Every aspect of the pump's design is based on feedback from clients across the continent, so we feel that this is currently the only pump on the market to address every one of their operational needs," he explains.

"We successfully launched the Curve into the South African market at Electra Mining and to the world at the International MINExpo held in Las Vegas. We now feel that we are well on our way to becoming renowned worldwide as the leader in the design, manufacture and application of heavy duty slurry pumps."

Buitendag goes on to say that by establishing an extensive network of sales and service 'hubs' throughout Africa in order to provide efficient client service, "we are committed to being a trusted global partner".

The Curve pump was three years in the making and emerged from a clean sheet approach. The range offers decreased energy consumption throughout the product life cycle, TOC reduction, longer wear life, increased efficiency and improved safety for personnel during both installation and maintenance.

Buitendag contends that the slurry pumping industry was overdue for the launch of a cutting-edge pumping product saying that no significant advancements had been made to products on the market for almost 50 years. "With the rate of technological advancements happening in the mining industry, we felt that a new slurry pumping product was desperately needed. We proceeded to allocate a significant portion of our development resources to collecting customer feedback and packaged this into what we feel represents the new generation in slurry pumps," says Buitendag. "The end result is a benefit-saturated product that enables PAT to strengthen our clients' operations."

In designing the Curve, PAT's expert design and engineering team relooked at the traditional internal hydraulic layouts found in most slurry pumps. Leaning on their knowledge of what the market requires, they created an innovative design that was applied to the specific geometric size and the exact profiles of hydraulic passage through the pump. "When plotting the specific geometric size against total lifecycle cost there is a point where capital and operational costs achieve a combined optimum. Every model in the Curve range is sized to hit this optimum and deliver the lowest ownership cost to the end-user," Buitendag explains.

Knowing that cost is always a key factor for mining operations, PAT's designers ensured that low energy consumption was prioritised in design and that the Curve could be retrofitted to legacy pumping systems with minimal changes to existing piping.

"We are extremely proud of the product that we have been able to bring to the market. The innovative advancements we have made are a result of the combined capabilities of our entire team. Thanks to their expertise, we now have a slurry pump that offers a reduction in downtime by up to 80%, a 40-60% reduction in total ownership costs and – thanks to our strategic distribution – shorter delivery lead time," Buitendag says.

Pump and Abrasion Technologies is a manufacturer and supplier of heavy-duty pump solutions to the mining, mineral processing, industrial and agricultural segments with ISO 9001 accreditation. The company has developed a range of premium quality pumps and after-market pump spares, offered at competitive prices and comprehensive ongoing service.

The company is based in Centurion, South Africa but its' operational footprint extends to Botswana, Ghana, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe and other African territories. ❑

Pump and Abrasion Technologies (PAT) unveils its Curve™ product range to the African market at Electra Mining 2016.

Better API pumping solutions

Peter Middleton talks to Weir Minerals' GM for products, Ronald Govender, and dewatering product manager, Kevin Roelofse, about two modern API pumps for the petrochemical industry: the Floway vertical spindle pump for high flow applications and the new WSP Roto-jet, Pitot-tube between-bearings pump for high-head low-flow applications.

Kevin Roelofse and Ronald Govender.

"We at Weir Minerals are well known in Africa for our mill circuit and slurry pumping solutions, through our Weir Warman and Envirotech brands. We have serviced the mining sector extensively over the years, developing our technology advances and, through mergers, expanded our offering to include a wide spectrum of inter-related, high-quality equipment solutions, such as Trio crushers, mill liners, cyclones, valves, piping and rubber and ceramic wear solutions," begins Govender.

"All of Weir's development efforts have targeted reduced total costs of ownership – through better reliability and improved uptime – along with better efficiency, productivity and profitability," he adds.

"What is less well known is our global strength in the petrochemical industry. Weir has a £600-million Oil and Gas business, with a notable presence in the Middle East and considerable expertise in fracking, for example. Included in this offering are several API compliant pump brands that, between them, cover a very wide spectrum of needs in the petrochemical and oil and gas industries," Govender tells *MechChem Africa*.

"We see niche opportunities in Africa for two of our API pump ranges: our Floway Vertical Turbine Pumps for high flow applications and our new WSP Roto-Jet Pitot-tube pumps, which offer significant advantages in high-pressure low-flow applications," he reveals.

Describing the different requirements for pumping petroleum, hydrocarbon or chemical products, Roelofse says that, due to their explosive and/or hazardous nature, product leakage is 100% unacceptable, so double mechanical seals, along with their auxiliary flushing and pressurising systems, are always required.

"These products are often pumped hot, so thermal expansion rates have to be taken into account. Shaft flexing and pump vibration levels must be minimised to avoid premature damage to the mechanical seals and bearings; hydrocarbon products have a low specific gravity, so the suction pressure (NPSH) has to be raised; and low vapour pressure means that higher pumping pressures are needed to avoid cavitation.

"The requirements for pumps in the petroleum industry are specified in API 610 and we are now at Revision 11," says Roelofse. "The standard specifies six governing criteria, and if any apply, then a pump compliant to the API standard should be considered," he notes.

Floway vertical turbine pumps

Made in Fresno California, Weir Minerals' Floway VHP series pumps are compliant with the current API 610 standard. "They are classified as VS (vertical spindle) pumps and Weir has several of the API plans in its range.

"Floway VHP VS6 pumps are now draining an oily water sump at a local refinery pumping hydrocarbons, for example. These pumps have their spindle enclosed in a can or bowl about 6.5 m deep, with the inlet above. This creates additional head, raising the true NPSH by increasing the vertical column length in the can," Roelofse explains.

"Our VHP VS1 pumps, on the other hand, have an open spindle, which means that the liquid level in the tank or sump must always be kept above the top of the spindle to ensure adequate suction pressure," he tells *MechChem Africa*.

The installation of a Floway vertical turbine pump on a Multiflo barge.

"We also have six non-API Floway pumps being used to extract condensate from a power station in Zimbabwe. The condensate water is at 60 to 65 °C, so it is prone to vaporisation and cavitation. The vertical spindle arrangement with its raised column increases the head on the suction side, helping to overcome this problem," he adds.

"Floway VTPs are also ideal for water transport and, in the US, these pumps are much more commonly used than split-case horizontal pumps. Here, we have them installed in mining pontoons for pond water transfer, for example, where sophisticated API features such as mechanical seals are not needed. They are a more cost-effective option in this application than using centrifugal pumps with high-level specs and a big impellers," he notes.

The WSP Roto-Jet

One of the original developers of the Pitot-tube pump was Tom Maceyka, now a Weir employee, who was largely responsible for getting the technology added to API 610. "The principle is not new. It has been widely adopted in the global petrochemical industry for high-pressure, low-flow applications," says Roelofse.

"What is new is our WSP Roto-Jet type BB6, which is a pump suspended between bearings, unlike original designs that were overhanging. This ensures better shaft rigidity, less vibration, longer seal and bearing life and it enables these high-pressure pumps to comply with every criteria listed in the API specification," he continues, adding that almost all other API pumps have deviations of some sort or another.

Pitot tube pumps compete directly with high-speed centrifugal pumps, which have to operate at 24 000 rpm to achieve the head and flow requirements. "Our Roto-Jets have an integral gearbox that enables them to run at 6 000 rpm. The pumps can typically produce 1 550 m heads, which is extremely high for

Left: *A high head, low flow direct-coupled Pitot-tube Roto-jet pump.* ***Right:*** *The Weir Minerals team installing a Floway VTP pump.*

a single stage pump, and flow rates of up to 85 m^3/h, which is relatively low.

WSP API Pitot-tube technology is ideally suited to high-pressure applications in petrochemical plants: for naphtha injection applications, for example, or treating amine, transfer services and reactor feed. "Naphtha is often used to make hydrocarbons easier to pump and, because of the low vapour pressure and high process temperatures involved, these must usually be pumped at high pressure," Roelofse explains.

Describing how Pitot tube pumps work, he says that a stationary Pitot tube is placed inside a rotating housing. "As the liquid comes in, it is transferred outward via vanes in the rotating housing to the outer circumference, picking up kinetic energy (½ mv^2). Swirling liquid around the outside of the housing is forced into aligned stationary nozzles in the Pitot tube, which channels the flow back towards the centre of the pump.

"By increasing the cross sectional flow-area of the Pitot tube as flow progresses towards the centre, the fluid velocity is reduced and a high pressure is generated," Roelofse explains, "because ½ mv^2 is converted into mgh," he adds.

"Compared to centripetal pumps for this application, the Pitot tube pump is much less sensitive to process upset conditions: such as total shut off on the discharge or total open line. Roto-Jet pumps have proved reliable under these conditions."

He says that high speed centripetal integrated gear pumps operate at 18 000 to 25 000 rpm, so "when something goes wrong, a lot of rotating energy has to be dissipated and damage often results. These pumps can also never be run dry, so complex fail-safe systems, by passes and controls are necessary.

"The Pitot tube solution, therefore, is safer, simpler and more reliable," he tells *MechChem Africa*.

From an efficiency, performance and response perspective, the design of the Roto-Jet significantly outperforms centripetal pumps. Based on the pump curve for a 300 kW Roto-Jet pump, Roelofse says that at a pump speed producing 10 m^3/h of flow, the pressure will be at 1 300 m of head.

"Centrifugal pumps operating at these high speeds are usually far from their best efficiency points (BEP). The efficiencies being achieved are typically below 10%. They also tend to be susceptible to cavitation and the radial loads can be so high that shafts can snap.

"With the Roto-Jet pump, about half of the pressure is generated by the rotating housing, while the other half is generated through the stationary Pitot-tube. Far less weight is being rotated at much lower speeds, so the motors required are much smaller and the net pumping efficiency is much higher, typically near to 50%. This does mean that the pressure is impacted by any increase or decrease in velocity, though. If, however, the flow requirement increases, this can easily be achieved by installing a Pitot tube with a larger area. Then the higher flow can be achieved at the pressure point without having to increase the rotational speed," he notes.

In a like-for-like cost of ownership comparison (see table below) for pumps at the same operating point, the initial pump costs of a Roto-Jet is already 33% cheaper (R100 000 versus R150 000). Due to its improved efficiency (49% as opposed to 7%), and lower power draw (33 kW as opposed to 220 kW), the 20-year electricity cost is significantly lower (US$460 061 compared to $3 097 536). "$154 877 in energy savings per year mean that the initial $100 000 cost can be recouped in just less than eight months," Roelofse calculates.

Any disadvantages? "Only that these have a slightly larger base plate," he responds.

"The installed base of the overhung Pitot tube design in the US is extensive. But we don't really know about this design here in South Africa, apart from some units in our paper mills," he says.

Govender concludes: "These technologies fit very comfortably with our aim to reduce TCOs for operators – and we are very happy to prove this by installing a test pump on a site, for free, should a customer be interested in trialling this technology alongside their existing pumps." ❑

	Roto-jet	BB2 Centrifugal
Efficiency	49%	7%
Power (kW/hp)	33/44	220/296
Initial cost (US$)	100 000	150 000
Energy consumption (kWh)	460 000	3 097 536
Approximate cost of ownership	**$560 061**	**$3 247 536**

A like-for-like cost of ownership comparison for a Roto-jet and a BB2 centrifugal pump at the same high-pressure operating point. For the Roto-jet pump Roelofse calculates that: "$154 877 in energy savings per year mean that the initial $100 000 cost can be recouped in just less than eight months,"

Resolving fractured debates about fracking?

The shale gas industry in South Africa

In this article, which was first published in the *'South African Journal of Science'*, John Butler-Adam reports on the fractured debates about fracking and results of the ASSAf consensus report[3], which was launched on October 12, 2016.

The Preston New Road Action Group from Lancashire, England, a local anti-fracking group, said it was 'devastated' by the decision to go ahead with fracking. "This is a sad day as it is clear to all that this [UK] government neither listens, nor can it be trusted, to do the right thing for local communities. It is deplorable that a [fracking] industry that has been rejected on every level has inflicted itself on Preston New Road," said Pat Davies, the group's chair.[1]

And in the Eastern Cape of South Africa, Chief Khomotsoana Lebenya has made a solemn vow[2] to his more than 20 000 subjects the: "Fracking will not happen here. It will not happen, I promise you. We will chase them."

The extraction of shale gas is often said to have considerable benefits as an alternative and relatively new source of energy and as a creator of jobs, with the consequent social and economic advantages that follow. Why, then, would communities as different and geographically far apart as those in Lancashire and the Eastern Cape be so determinedly opposed to fracking? The reasons are numerous: the extraction process is water-intensive in the face of water scarcity; the potentially carcinogenic chemicals used in the process may escape and contaminate ground water; air pollution is also common; heavy transport (for equipment and water) will have substantial environmental impacts; and the activity can ruin valuable or tourist-intensive landscapes. In short, the extraction of shale gas may well present significant environmental, technical, social and economic challenges – along with any benefits that it might bring.

It is for these reasons that the Department of Science and Technology (DST) approached the Academy of Science of South Africa (ASSAf) to undertake an assessment of South Africa's technical readiness to support hydraulic fracturing. ASSAf responded by using the well-tested and effective approach of establishing a consensus study in which a panel of experts undertook the various tasks needed to help to answer the core question. ASSAf launched the resulting consensus report[3] on 12 October 2016 – which has resulted in a substantial number of media reports on the panel's findings and recommendations.

Not surprisingly, the report is extraordinarily comprehensive and covers, in detail, a wide range of background material. This material includes international perspectives, factors to be considered in the case of the Karoo (not forgetting possible impacts on astronomy), a detailed analysis and the presentation of factors and the elements of readiness to be considered in the production phase, conclusions that can be drawn, and all-encompassing recommendations.

Amongst the conclusions reached by the panel, the following are perhaps amongst the most critical. Firstly, there is a need for South Africa to assess the extent of technically recoverable shale gas resources and to commit to a balanced long-term gas exploitation strategy, taking account of the security of supply, efficiency of extraction, environmental protection and effective communication to society.

Secondly, it is essential that controls be identified and implemented regarding externality costs associated with mines and abandoned mines, and that these controls be in place even before the implementation phase begins. Third on the list is the need for a rigorous environmental impact assessment of both upstream and downstream shale gas processes and determination of the most economically, socially and environmentally optimal gas source. Fourthly, water availability and use, as well as the impact of methane emissions must be assessed and monitored – another facet of environmental, social and health assessment.

The fifth conclusion drawn by the panel focuses, appropriately enough, on the potential impacts of mining on the astronomical work in progress and moving forward in Sutherland. Fracking and its supporting activities present a real risk to the scientific operations and performance of the Square Kilometre Array (SKA) and its complementary research utilities and functions. The extreme sensitivity of the SKA means that even the weakest of human-made radio signals is detectable at some level, and in some part of the radio frequency spectrum across which the SKA will operate. To minimise the potential impact of this risk, careful management and coordination with stakeholders is needed, along with the establishment of safety limits.

Sixth, comes the critical matter of the social and economic impacts of, and implications for, the mining. So far, much of the focus at a broad level has centred on the wider economic impacts and benefits to the national economy and energy balance, but completely inadequate consideration has been given to the localised effects of the impacts and consequences that will be faced and experienced in local environments. Then too, comes the seventh set of conclusions, critical if for no other reason than that they have been neglected in South Africa for over a hundred years: what happens when the mining operations come to a material or economic end? Ensuring complete maintenance throughout the operational life of wells, and after their closure, must form an essential part of any shale gas mining operation.

The report sets out three further conclusions relating to baseline studies prior to implementation; to the distribution of the gas; and to the importance of capacity and related skills development. These are clearly of equal importance.

These conclusions lay out essential steps that must be taken and actions that must be implemented if the fracking goes ahead. There is little doubt that the DST will take them seriously, as it is a department fortunate enough to have excellent leadership. It is very clear, however, that the Ministries of Mineral Resources and of Energy appear not to benefit from the same quality of leadership or commitment to good, honest practice.

Which brings us decisively back to the community activists. Should fracking proceed, to a greater or lesser degree, then the panel's conclusions (and recommendations) must be the essential, unchallenged foundations for the process. In this case, the activists still have an unquestionably critical (and possibly even more important) role to play: that of vociferously and persistently holding the state and its various arms to full account. ❑

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How hydraulic fracturing works:

Edited from an OilPatch CopyWriter article by Cyndee Davis.

A wellbore is drilled using a drill pipe and bit. Mud is pumped down to the drill to cool and lubricate the drill pipe and bit. This helps to stabilize the wellbore and helps carry rock fragments to the surface.

Drilling continues way past groundwater levels and typically, over 500 m of rock separates the shale reserves from the lowest groundwater reservoirs.

The drill pipe and bit are removed and a steel tube called surface casing is set inside the well. The tube stabilises the sides of the well, creating a protective barrier between the well stream and any underground fresh water reservoirs. Cement is then pumped into the well, through and out of the casing, displacing remaining drilling fluids and securing the casing in place permanently. Filling the gap between the casing and wellbore cement creates a protective seal, keeping outside materials from entering the well flow.

The casing is pressure-tested to make sure hydrocarbons and other fluids do not seep out as they are brought to the surface.

Drilling continues and another layer of casing and cement are set in place to create a second permanent protective barrier. These multiple layers of casing and cement are critical for safe well construction and to protect drinking water.

At about 150 m above the hydrocarbon shale formation a specific drilling motor with sophisticated measuring instruments begins drilling at an angle to create a horizontal path into the targeted layer of gas or oil bearing shale. The casing and cementing process continues through the entire length of the now horizontal wellbore.

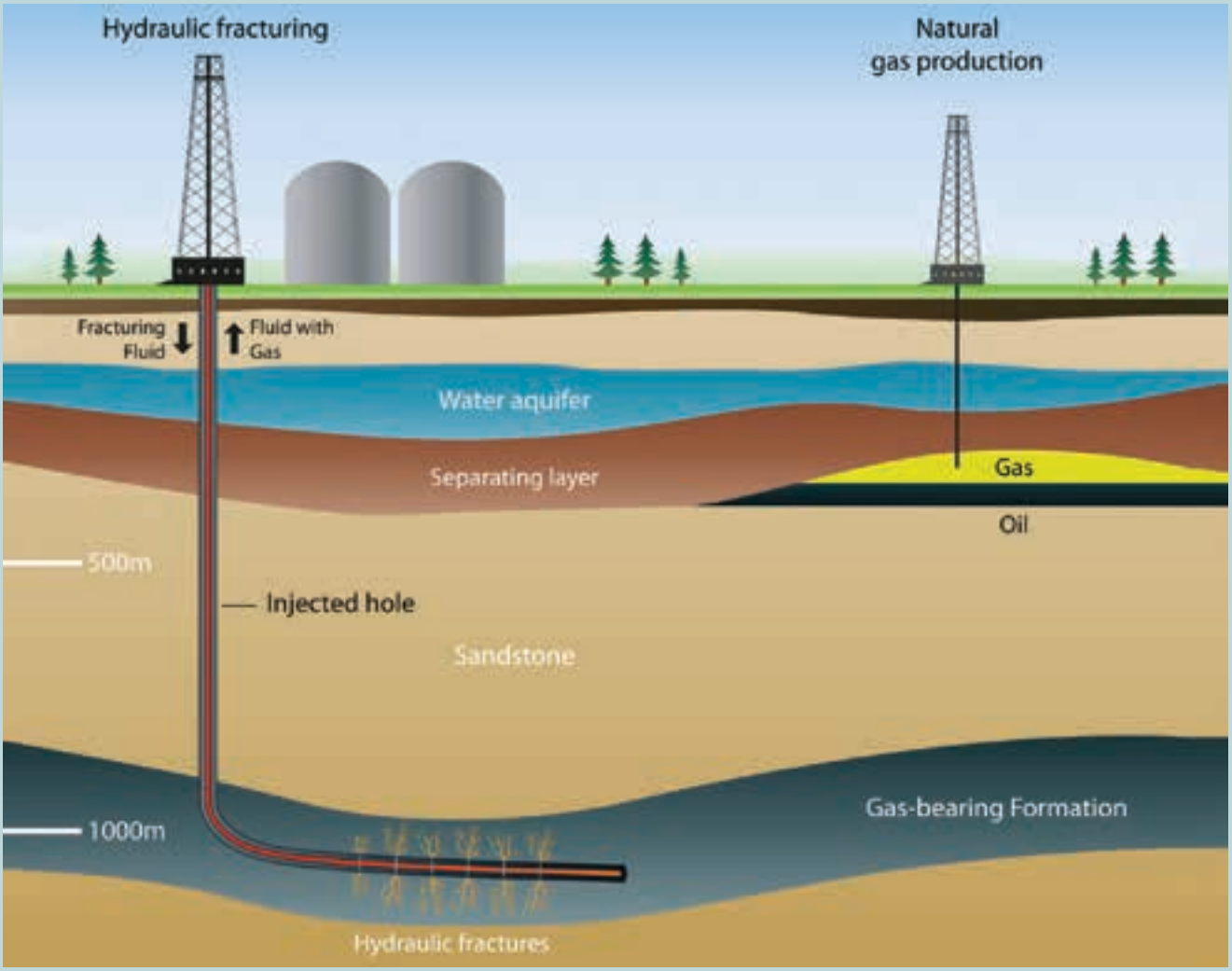
A perforating tool is inserted into the well, creating holes in shale layers to allow the hydrocarbons to enter the well stream. Once the perforating tool is removed, a fracturing fluid made up of water, sand and small percentages of a chemical solution, is pumped into the well, opening up tiny fractures deep into the shale.

Once the water is removed, the sand remains, holding the fractures open. This makes it possible for gas or oil to travel from the shale out into the well.

Bridge plugs are inserted, allowing the fracturing process to continue across the whole length of the horizontal well. After the fracturing process is completed, all the bridge plugs are removed, allowing the gas or oil to flow freely to the surface.

On average it takes four to eight weeks to prepare a site for drilling and a further four to five weeks during which the casing and cementing occurs. Hydraulic fracturing, itself, only takes between two to five days, making the entire process fracking from start to finish, a total of seventy to a hundred days.

Following the establishment of a well by fracking, the facility can typically produce energy for 20 to 50 years. Trucks, pumps and equipment are removed, leaving only a production valve and collection equipment on the land surface. ❑



The establishment of a shale oil or gas well by fracking typically takes only eight to 12 weeks, with the hydraulic fracturing only taking two to five days. After this time, a well can produce oil or gas for 20 to 50 years.

New biogas market on the horizon

Industrial gases company Afrox is partnering with biotech start-up, New Horizons Energy, to turn organic waste destined for landfills into useable products for South African industries.

New Horizons Energy will soon be turning organic waste into usable bio-methane at purity levels of over 90%. Furthermore, the addition of a brand new carbon dioxide source to the Afrox portfolio will add significant capacity to Afrox' national, but more importantly Western Cape, infrastructure.

The New Horizons plant is located in Athlone, near Cape Town and is expected to start generating biogas by mid-2017. Afrox will then distribute the compressed bio-methane to its customer base as an alternative to LPG and/or diesel.

Bio-methane (also known as biogas or compressed natural gas) is a proven alternative to existing fuels used primarily for heating applications across a multitude of sectors and processes ranging from food production to metal fabrication, as well as for the generation of electricity.

"Afrox is currently in discussions with potential customers about the advantages of a local source of bio-gas in the Western Cape," says Afrox's Heinrich Uytenbogaardt, strategic marketing manager bulk markets. "And while compressed natural gas (CNG) is already widely used in many countries around the world, this is still a relatively underdeveloped market in South Africa and in Cape Town in particular; but one we expect to grow.

"The upgraded bio-methane from the New Horizons plant in Athlone has a number of advantages over other fuel sources currently available in the Western Cape; it is cleaner burning with far lower sulphur- or nitrogen-oxide emissions, and it will have a far more consistent quality, which is especially valuable in the processing industries.

"In addition, the benefits to the environment are worth noting, as the process eliminates the need to send waste to landfill and less harmful greenhouse gases are generated from the use of bio-methane versus other conventional fuels."

The carbon dioxide storage facility comprising vessels specially designed and manufactured for Afrox have been brought in via the Cape Town port and are awaiting commissioning of the New Horizons' facility in Athlone.

The carbon dioxide produced by the energy's plant is allocated to meet existing market requirements of the Western Cape industry, agriculture and wastewater treatment customers. This is a renewable on 'the-door-step' gases solution. Currently carbon dioxide for the Western Cape market is predominantly sourced from Mossel Bay, which is more than 380 km away.

The New Horizons plant in Athlone near Cape Town is expected to start generating biogas and CO_2 by mid-2017. Afrox will then distribute the gases to its customer base.

"Renewable energy sources such as the New Horizons Energy plant can make a meaningful contribution to South Africa's energy needs going forward," says Uytenbogaardt. "Taking waste organic matter, separating out the recyclable material and then digesting it to produce carbon dioxide and bio-methane will increase the contribution of renewable energy to the Western Cape's energy mix."

Currently, South Africa is reliant on methane/natural gas, supplied from Mozambique; but New Horizons Energy plans to supply local bio-methane to businesses across South Africa with further plans to roll out more anaerobic digestion plants to other provinces going forward; utilising Afrox's extensive supply chain and gases expertise.

Afrox entered into a long-term purchase agreement with New Horizons Energy in early 2015, under which Afrox will purchase all carbon dioxide and compressed bio-methane gas from the Athlone plant for resale and distribution.

"This is a relatively new technology for South Africa and it is exciting with respect to its growth potential and the variety of possible applications for local markets," Uytenbogaardt concludes. ❑

Afrox secures Western Cape LPG stocks

Consumers can expect ongoing security of supply of Handigas thanks to Afrox's plans to import LPG through the port of Cape Town. The first 2017 stocks of LPG have docked and were off-loaded into waiting Afrox tankers from the carrier GasChem.

"This shipment of LPG marks the ongoing commitment by Afrox to keep Western Cape customers fully stocked with LPG," says Afrox head of LPG, Mark Radford. "The aim of importing directly into Cape Town is to ensure both domestic and industrial customers have seen the last of stock shortages in the region.

"In particular, this has to be excellent news for consumer demand for Handigas, which skyrockets in winter when local stocks and availability of LPG have tended to run low or run out completely in previous years."

As part of its strategic plan for LPG, Afrox has an additional import agreement with Petredec Limited, one of the largest global liquefied petroleum gas (LPG) traders, to ensure security of supply for existing customers nationally. These import agreements aim to ensure a steady supply of Afrox Handigas to the consumer and to promote the use of LPG as an alternative to electricity and paraffin for heating, cooking, hot water, braaiing, camping, hiking purposes and domestic LPG power generators. ❑

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Mobile heater skid for 127 km natural gas pipeline

Energas Technologies has completed a commission to design and supply a mobile heater skid for the high-pressure natural gas line between Mozambique and South Africa.

The existing 865 km Mozambique to Secunda Pipeline (MSP) for natural gas from Mozambique to South Africa is currently the only sustainable source of natural gas to South Africa and, in order to meet the demand for natural gas in South Africa, the transport capacity of this line has been significantly increased. In order to facilitate this increase, a combination of compressors and parallel lines – at approximately 128 km per section – had to be built.

The Republic of Mozambique Pipeline Investment Company (ROMPCO), owner of the existing pipeline, represents a joint initiative between Sasol, Companhia Mocambiçana de Gasoduto and the South African Gas Development Company (iGas), and has played a pivotal role in commercialising Mozambique's natural gas supply.

With the backing of a successful first project, Loop Line 1, Sasol Group Technology, which was spearheading this project at ROMPCO's behest, appointed VGI Consulting Africa as the EPCM contractor for the Loop Line 2 (LL2) undertaking.

The 26-inch LL2 adds further capacity to the system through the installation of a 127 km parallel pipeline to the existing MSP line that ties back into the MSP. The importance of this gas supply cannot be understated. Much of the supply is fed to the Gauteng region in South Africa, a commercial and industrial hub that has earned the city of Johannesburg the title of 'Africa's powerhouse'. This feeder line supports residential, commercial, power generation and industrial heating requirements in the Gauteng area. Further to this, the supply also supports the operations of Sasol's liquids and chemical plants in Secunda and Sasolburg as well as other large, energy-intense industries nearby.

Commissioning of LL2 with Energas mobile heater skids

For the commissioning of LL2, the new line was filled and pressurised from atmospheric pressure to a line pack pressure of 116 bar. The filling gas had to be preheated to ensure the temperature did not drop below the pipeline minimum design metal temperature of zero – due to the Joule Thompson cooling effect – while the flow rate was controlled and monitored. A flow totaliser added the benefit of measuring the normalised volume of gas consumed to achieve the required line pack.

The project specification called for the design, manufacturing and supply of a transportable skid-mounted electrical gas heater with flow control in accordance with ASME 31.8, ASME VIII and SANS 10108. Design, fabrication, complete assembly and testing of the heater skid were done in South Africa before delivery to site in Mozambique.

Laetitia Botha, Energas Technologies product engineer comments: "Energas specialises in the design, manufacture and supply of skid-mounted pressure reduction and metering stations to the natural gas industry. Most of these skids are for sites in remote areas and being able to complete the fabrication and assembly in South Africa significantly reduces schedule risk, site establishment and workforce logistics.

"Another benefit of the mobile heater skid is that it could be relocated and used at different site points or locations as the new pipeline sections were being constructed. The heater skid is only required once during the commissioning of a new section and it is therefore not required as a permanent installation. It's a cost-effective solution to invest in a mobile skid that can be relocated where needed."

The heater skid comprises a thyristor control panel, a 416 kW heater with isolation valves, flow meter, filter, instrumentation and manually operated control valve to measure, heat and control the filling of LL2 during commissioning. The thyristor controller monitors the gas temperature at the outlet of the control valve and controls the power to the heater's elements in order to maintain an outlet gas temperature of 10 °C. During commissioning the electrical heater was powered by a diesel generator.

A Mokveld equal percentage axial flow manual control valve was chosen to control the flow of gas from 116 bar to, initially, atmospheric pressure. This required a special trim that allowed precise control while noise and vibrations were very low. The control valve and heating capacity allowed the LL2 commissioning team to make effective use of the gas volumes made available by the pipeline operator, leading to the pipeline being commissioned much sooner than originally anticipated.

"The natural gas industry both in South Africa and Africa is a growing one and has a bright future ahead. We have directly felt the effects of this growth through ongoing skid manufacturing projects in Ghana, the Western Cape and Mozambique," Botha concludes. ❑

The heater skid comprises a thyristor control panel, a 416 kW heater with isolation valves, flow meter, filter, instrumentation and manually operated control valve to measure, heat and control the filling of LL2 during commissioning.

Addressing industrial energy costs and availability

As a side event to the African Energy Indaba 2017, The National Cleaner Production Centre (NCPC-SA) hosted an Energy Efficiency Workshop in partnership with the Consumer Goods Council of South Africa (CGCSA) and the Chemical and Allied Industries Association (CAIA). *MechChem Africa's* Glynnis Koch attends and reports.

In her capacity as executive director of the Southern African Association for Energy Efficiency (SAEE), Valerie Geen was chosen as Programme director and MC for the day. Geen is a former head of energy at the NBI (National Business Initiative) and is now a projects expert with the United Nations Industrial Development Organisation (UNIDO).

The panelists for the morning discussion consisted of: Alex Haw, general manager for corporate sustainability, Massmart; Crescent Mushwana, research group leader for Energy Systems, CSIR Energy Centre; Deidre Penfold, executive director, CAIA; Ndivhuho Raphulu, director, NCPC-SA; and Sisa Njikelana, energy patron of the SA IEE project, former chair of the Independent Power Producers Association and the Parliamentary Portfolio Committee (Energy).

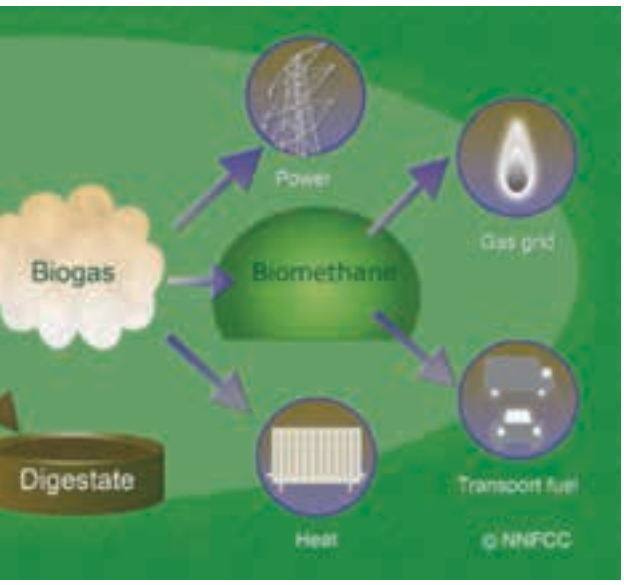
Alf Hartzenburg, national project manager, SA Industrial Energy Efficiency Project, NCPC-SA, began proceedings with a keynote address in which he noted that the NCPC-SA must position itself as a 'centre of excellence', capable of being a source for producing experts for various energy efficiency solutions as well as a of cleaner production systems and data in South Africa. Driving success is the harnessing of behavioural change, and developing mentors, interns and graduate engineers, he said, citing examples of the work that has already been done in Mozambique, Myanmar, Mauritius (a technical feasibility study for thermal plants), Germany and the USA. He also emphasised fostering women's empowerment, saying that many have found, in general, that women are better at managing improvements in energy efficiency than men.

Hartzenburg believes that lifecycle assessments of companies must be fast-tracked and the monitoring and evaluation of companies must become more robust. Other challenges and opportunities include: intelligent biogas heating systems, smart power, storage technologies and intelligent drive and control systems. Although there is a growing base of technical expertise among managers, he noted that there was no room for complacency in the NCPC-SA. Rather, he stated: "We must maintain a sense of responsibility and keep up the good start that has been made in improving energy efficiency in South Africa." Quoting Abraham Lincoln, he added: "We must rise with the occasion, think anew and act anew."

An overview diagram of a typical biogas plant from the by presentation Sashay Ramdharee entitled:' Energy Efficiency gains through biogas'.

People have traditionally looked towards a specific technology to reduce electricity consumption in industrial applications, and, during one of her morning summaries Geen pointed out that the IEE project and

Case study presenter, Darryn McComb, photographed with panellists: Alex Haw; Valerie Geen; Crescent Mushwana; Deidre Penfold; Sisa Njikelana and Ndivhuho Raphulu.



its courses focus on implementing entire energy management strategies – how to get the policies implemented in accordance with standards, documenting the processes and ensuring that the participating company sees a return on investment. Energy management in its totality includes each and every measure an organisation has implemented or plans to implement, in order to ensure minimum energy consumption for the current activity. "Industrial energy management requires a holistic management approach," she stressed.

After the various panel members had discussed topics such as energy access and affordability, and taken questions from delegates, presentations followed on: Energy management systems; Energy modelling and alternatives; Energy systems optimisation; and Energy financing. The presenters offered practical solutions and opportunities and encouraged delegates and others to sign up to the subsidised services of the NCPC-SA for help with implementing energy management in their companies.

Popular panellist with a keen sense of humour, Sisa Njikelana, said that, in his opinion, the government was not taking up the gauntlet of energy efficiency, with little having been done since 2005 when a strategy was first established. He believes it is up to municipalities to take up the cause and target, not only private companies, but everyone. "Indeed, there are many challenges and opportunities ahead," he said, "but training, education and legislation have got to create the environment for enabling change; and this change management has to be the responsibility of our government in the end."

Njikelana is an ANC anti-apartheid struggle veteran who is currently a research fellow at the Centre of Competition, Regulation and Economic Development at the University of Johannesburg. He is also a former Member of Parliament (2004 to 2014) and Chairperson of the Portfolio Committee on Energy. In addition, for three years during the 90s, he was a counsellor in the Eastern Metro of the Greater Johannesburg Metro Council. Njikelana now sits as an executive and non-executive director on a number of boards.

Concluding his talk, he said that in the environment in which he has mostly worked, he would be told: "Honourable member, your time is up."

In the afternoon, industry case studies and success stories were related by other presenters, including Stephen Koopman, Energy Centre, R&D outcomes manager, CSIR, who spoke on energy modelling and alternative energies. The five research priorities of the centre focus on challenges associated with a large uptake of fluctuating renewables from the supply side, and the need for more efficient use of energy from the demand side. He briefly discussed these, which are: energy efficiency and demand forecasting; renewable energies; energy-system technologies; energy-system planning; and operation and energy markets and policy.

Faith Mkhacwa, a project manager at the NCPC-SA, gave a very clear and concise presentation on energy management systems and industrial efficiency opportunities, stressing the great importance of training and the valuable role that human behavioural change has on changing attitudes to the energy problems we face in our nation. She reiterated that an ad hoc approach to managing energy is not acceptable, and that a structured approach is definitely the way to go.

There were also talks about energy financing (Berrie de Jager of Standard Bank); energy efficiency gains through biogas (Sashay Ramdharee, project manager, NCPC-SA); and energy-focused tax incentives (Barry Bredenkamp, senior manager: energy efficient & corporate communications for SANEDI – the South African National Energy Development Institute). ❑

Industrial energy-efficiency initiative in SA

The Industrial Energy Efficiency (IEE) Project was established in 2010 in response to the growing need to improve the energy efficiency of South Africa, including the reducing of carbon-dioxide emissions and the increase of the effectiveness of in-plant energy management as a means of increasing profitability.

UNIDO, along with the Swiss State Secretariat for Economic Affairs, the UK Department of International Development and partnered by the Department of Trade and Industry (the dti) and the Department of Energy (DoE) of South Africa, embarked on a programme to address the global drive for greater energy efficiency. Since its inception in 2010, the IEE project has assisted industrial companies to reduce energy use by 2020 GWh, saving participating companies some R1.7-billion in energy costs.

The ultimate goal is to demonstrate the positive impact of energy management as a means of reducing carbon-dioxide emissions and to demonstrate the effectiveness and financial impact of in-plant energy management. The project focuses on skills development at both company and train-the-trainer levels, and also addresses system optimisation. This includes an audit and systemic approach to energy-efficiency and leads to better prospects of measurement and verification of energy savings, using best practice experience and expertise. This has been achieved through the promotion and implementation of Energy Management Systems (EnMS) and Energy Systems Optimisation (ESO) and the strengthening of industry capacity in the energy efficiency field.

Energy Management System (EnMS) implementation

In this procedure, the participating company is assisted with the developing of and implementation of an energy management system in line with the ISO 50001 Energy Management Standard. Expert mentoring support and advice is provided via access to national and international experts in the field of EnMS. The programme is typically run over nine to 12 months.

Energy Systems Optimisation (ESO) implementation

This programme offers industry the opportunity to systematically target selected systems within their processing facilities and intensely interrogate their performance and effectiveness. Participating companies are provided access to technical specialists to undertake assessments within their processes in order to identify improvement options for implementation. These assessments are significantly shorter than the EnMS programme, ranging from five to 15 days depending on the scale and complexity of the facility. ❑

Balama Graphite Mine powered by SA-built

The remote operation to mine one of the world's largest finds of high grade graphite – the Balama deposit in Mozambique – will be powered by a generator plant being constructed through South Africa-based Zest Energy, part of the Zest WEG Group.

One of the diesel generator sets for Syrah Resources' Balama graphite project, custom engineered and constructed by Zest Energy.

According to Alastair Gerrard, managing director of Zest Energy, the new generator being constructed in South Africa for the new graphite mine in Balama will begin producing electricity during the first quarter of 2017, with an initial capacity of 12.5 MW from an installation of seven 2 200 kW diesel generators.

"The isolated location of the Balama mine – over 250 km west of Pemba in northern Mozambique – means that while the operation does have access to power from the national grid this will need to be supplemented to ensure an adequate supply for full plant demand," Gerrard says. "We are therefore required by the customer to ensure 100% availability, and have consequently designed the plant with substantial standby capacity to allow for maintenance and repairs without affecting the continuous supply."

He says the plant, which was the largest footprint project yet tackled by Zest Energy, would initially run with seven 2 200 kW generators; six running and one on standby, and would later be expanded to include eleven generators, of which two will be standby units.

Equipment for the extensive scope of supply has been sourced from various companies within the Zest WEG Group, locally and worldwide. The containerised power generators include WEG alternators with automatic voltage regulation systems, as well as motorised louvres, generator auxiliary systems, and fuel and lube tanks. To cool the engines, a horizontal-type radiator system, rated for 50 °C ambient temperature, was manufactured in South Africa and each radiator includes 10 WEG 3.0 kW fan motors positioned in two cooling banks of five fans each.

"One of the challenges of the mine environment is the presence of graphite dust, which

Mobile power for Kamoa-Kakula mine development in the DRC

The development of the world's largest high-grade copper deposit – the Kamoa-Kakula Copper Project in the Democratic Republic of Congo (DRC) – is now running on power from the DRC's national grid using a mobile substation recently commissioned by South Africa's Gauteng-based Zest Energy.

The Zest Energy mobile substation in position on site, connected to the SNEL electrical network. The photograph shows preparations for hot commissioning and energising in progress.

The 120/11 kV mobile substation will serve the construction of the planned initial mine at Kamoa-Kakula, a project whose existing mineral resource has been independently verified as Africa's largest copper find. Kamoa-Kakula's principal owners are Ivanhoe Mines, Zijin Mining and the government of the DRC.

"Due to the high cost of running on diesel generators, the mine developers decided to purchase a mobile substation to interface with the network of the DRC power utility, SNEL, to provide power during the construction phase of the project," Alastair Gerrard, managing director at Zest Energy, says.

Although the substation will not be moved frequently, Gerrard says being mobile allowed for quick and hassle-free construction and commissioning, and gives the mine the added flexibility of deploying the substation to other areas of its operations when needed in the future.

Zest Energy – part of the Zest WEG Group – undertook the design, manufacture, supply, testing, delivery, installation and commissioning of the complete mobile substation, including the trailer, transformer and related electrical equipment. It also provided a pro-

generator plant

is highly conductive and must not be allowed to enter the power generation units," Gerrard says. "For this reason, a filter system was designed that could accommodate the high volumes of moving air required to cool the engines, while also requiring as little maintenance as possible."

Once again, a local solution was designed, in the form of a custom-engineered, self-cleaning cartridge type ventilation and pressurisation fan unit, comprising four WEG 7.5 kW fan motors.

To feed diesel to the generators, Zest Energy will install a 30 000 ℓ intermediate fuel tank to draw from the customer's bulk fuel storage system with a duplex fuel filtration and circulation system as well as all interconnecting piping, valves, pumps and fittings within the power plant area.

A local fuel connection point within the plant area will also be installed as a contingency, should bulk fuel supply not be available. To comply with environmental regulations, a bunded fuel and oil area will be constructed, with an oil-water separation system.

"There are also various systems we will provide for plant auxiliary power requirements and for plant earthing and lightning protection, as well as cabling, terminations, racking and supports to all plant electrical equipment," Gerrard says. "Through our member companies in the Zest WEG Group, we are able to give our customers a single point of contact for the range of services we are providing, while project managing and quality controlling every aspect of the power plant." ❑

The complete 35 t packaged diesel generator set being lifted for loading onto transport vehicle.

tection system, earthing, site work (with full commissioning and testing) and site training.

The project began in February 2016, and the unit was commissioned and handed over to the mine developer in October 2016, in line with a challenging delivery deadline of nine months.

"Our strong network within the WEG Group, of which Zest WEG Group is part, allowed us to work with WEG Transmission and Distribution in Brazil on transformer design, manufacturing and factory testing," Gerrard says. "We also involved WEG Transformers Africa – also a Zest WEG Group company – when it came to site assembly and testing of the mobile transformer."

The commissioning process included final assembly of the transformer, oil filtration and purification, and conducting a full spectrum of transformer tests, as well as on-site testing of all supporting substation equipment. To ensure strict compliance, all commissioning and testing was done in conjunction with SNEL to meet contractual and performance requirements.

Skills transfer was facilitated by operator training conducted by Zest Energy to all selected mine personnel, ensuring that the substation was left in safe hands, with a strong after-sales service to respond to any further customer requirements. ❑

Preparations underway to start with the scope of work on site, showing the arrival of supporting ancillary components to be installed, followed by cold and hot commissioning in the presence of specialists from the DRC Utility, SNEL.

All supporting ancillary components fitted to the mobile substation. Final preparations underway, ready to commence with connection to the SNEL electrical network.

PV training creates sustainable employment

ARTsolar, South Africa's locally owned photovoltaic (PV) manufacturing plant in, has implemented a certified training and facilities upgrade programme at its New Germany plant in KwaZulu-Natal.

Modules are soldered either automatically by robots or manually by skilled employees on the same line.

"As part of our pledge to create sustainable employment in manufacturing in the private sector, ARTsolar has offered intensive staff training to ensure every step in the quality control of producing PV panels is in accordance with international standards," says Qaphela Zikhali, ARTsolar's operations manager. "ARTsolar, in conjunction with expert instructors and engineers from Germany, Switzerland and China, has provided skills training to over 200 local matriculants.

"The company's training initiative also forms part of our commitment to providing long term solutions to the development of renewable energy in South Africa and our support of the Government's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), where the creation of job opportunities, local content and community development remain essential ingredients of the programme.

"By utilising the latest environmentally-friendly technology to convert solar energy to electrical power, ARTsolar provides reliable and independent electricity to support the country's growing economy and to combat the effects of rising utility costs. Local interest in PV technology has heightened since the launch of the REIPPPP and PV modules are gaining popularity as a form of renewable energy that is clean, emission and noise-free, sustainable, safe and cost-efficient."

ARTsolar – the first local PV module manufacturer to participate in the REIPPPP – has completed the module supply of 65 MW in Round 2 and 86 MW in Round 3 and will continue to expand its facilities at the plant to meet production requirements for the next phase of this programme.

Expanded facilities have a production capacity of 130 MW per year, which equates to approximately 412-thousand, 315 Wp Polycrystalline PV panel modules.

ARTsolar has made a substantial investment in new equipment to meet the REIPPPP production requirements.

The company will again partner with international PV companies to ensure production for the REIPPPP in 2017 continues to meet stringent quality, safety and environmental standards. Modules will also adhere to Government requirements, which include the percentage of local content necessary.

ARTsolar, with an understanding of distinct South African conditions, is committed to the development of PV modules specifically suited to local climate conditions. PV panels are designed for large-scale power plants, mines and rural electrification, as well as industrial and residential roofing. Modules with enhanced aesthetics are manufactured for residential and commercial installations.

"This environmentally friendly system can also be integrated into roofs and facades to reduce the energy that buildings consume," suggests Zikhali. ❑

US$75-million power order for transmission link in Brazil

ABB has won an order worth around $75 million to supply advanced converter transformers for the Belo Monte 800 kilovolts (kV) ultra high voltage direct current (UHVDC) transmission link in Brazil.

The 2 518 km link will transmit clean power generated in the north of Brazil, from the Xingu substation, to the Rio Substation in the southeast. It will be capable of transporting up to 4 000 MW of electricity – enough to meet the needs of around 10 million people. The order was booked in the fourth quarter of 2016.

"Ultra high voltage technologies are a key focus area of our 'Next Level' strategy, and our advanced converter transformers are making it possible to integrate renewable energy sources and transmit clean power across long distances with minimum losses, reliably and efficiently," says Claudio Facchin, president of ABB's Power Grids division. "We have a long and successful track record in Brazil and remain committed to continuing to support the country's power infrastructure development."

ABB supplies for the Belo Monte UHVDC link include fourteen 400 MVA, 400 kV converter transformers and other related equipment. Converter transformers are among the most vital components in a transmission system, enabling grid stability and power reliability, while minimising losses.

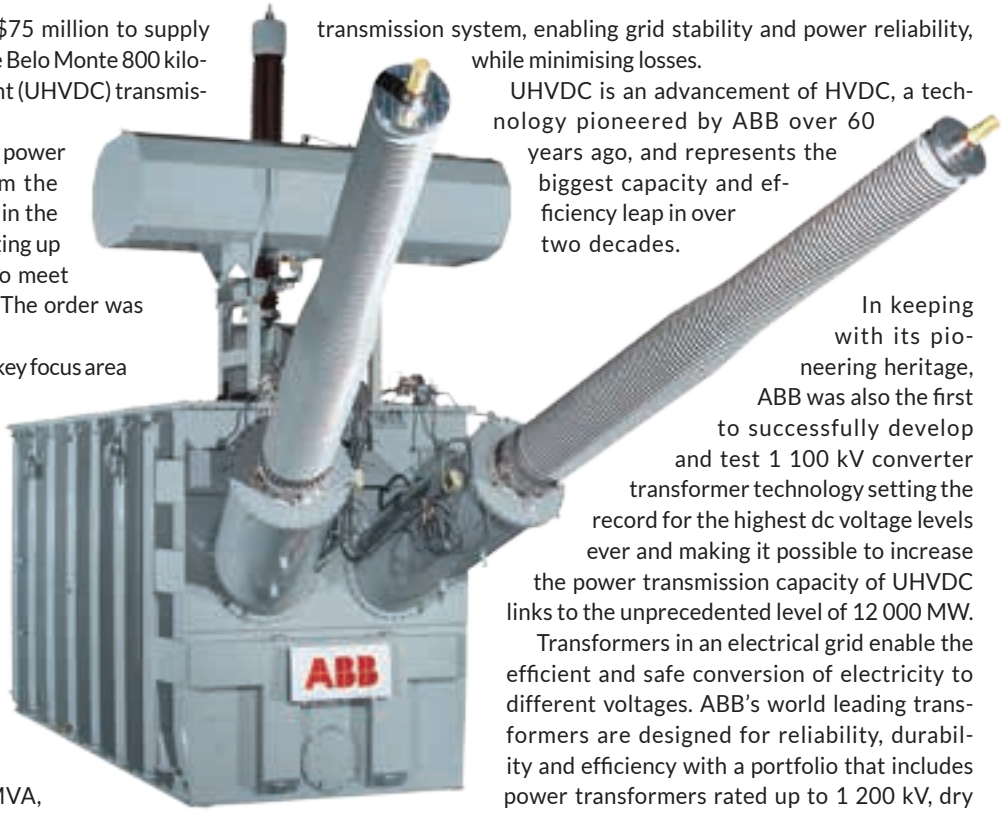


ABB supplies for the Belo Monte UHVDC link include fourteen 400 MVA, 400 kV converter transformers and other related equipment.

UHVDC is an advancement of HVDC, a technology pioneered by ABB over 60 years ago, and represents the biggest capacity and efficiency leap in over two decades.

In keeping with its pioneering heritage, ABB was also the first to successfully develop and test 1 100 kV converter transformer technology setting the record for the highest dc voltage levels ever and making it possible to increase the power transmission capacity of UHVDC links to the unprecedented level of 12 000 MW.

Transformers in an electrical grid enable the efficient and safe conversion of electricity to different voltages. ABB's world leading transformers are designed for reliability, durability and efficiency with a portfolio that includes power transformers rated up to 1 200 kV, dry and liquid distribution transformers, traction and special application transformers and related components. ❑

Can waste solve the waste problem?

The existing 'take-make-dispose' model of production and consumption is untenable. To halt the downward spiral of waste generation, it's time to rethink and redesign how we consume for a circular economy, says Aurecon's Tim Plenderleith.

Who ever said 'happily ever after' was just the stuff of fairytales? These days those words are written into the soles of Lionel Messi's cleats. Or at least, that's the idea. The 'Sport Infinity' range by sports apparel company Adidas uses worn-out cleats and, by combining them with scrap materials from other industries, re-imagines them into high quality new shoes. "The football boots of the future could contain everything from carbon used in aircraft manufacturing to fibres of the boots that scored during the World Cup," Adidas said in a statement. It's called infinity recycling – one of the many good ideas wrought by circular economy thinking – and it may just be the Sunday game norm someday.

With three billion new middle-class consumers expected to enter global markets in the next 15 years, we can expect three billion more hungry appetites for the resources and infrastructure required to meet their lifestyle demands. Currently, our economy is run by a 'take-make-dispose' linear approach that generates a breathtaking amount of waste. According to Richard Girling's book *Rubbish!*, 90% of the raw materials used in manufacturing doesn't even make it out the factory doors, while 80% of products made are thrown away within the first six months of their life cycle. The resource crunch is more like suffocation, with our incriminating fingerprints all over the planet's throat. The extractive industry's approach is unsustainable – raw materials are being depleted more quickly than they can regenerate.

In the circular economy, products are not downgraded, as they are in recycling, but re-imagined to infuse the same, if not more, value back into the system. The circular economy may be a highly practical solution to our planet's burgeoning woes. The idea behind a circular economy is to rethink and redesign the way we make stuff. Rather than ditching your worn-out old jeans, send them into the factory for recycling and upgrade to a new pair. Done with your old iPhone 5? Reconsider buying the Puzzlephone, which can be easily disassembled, repaired and upgraded over a ten-year lifespan. Basically, there's no such thing as waste in a circular system – all waste bears the raw materials to become something else . By finding fresh, creative ways to use the same resources, a one-way death march to unsustainable collapse is inadvertently avoided.

Could we halt the downward spiral by using waste to solve the waste crisis? With McKinsey rolling out projections as high as $1-trillion to gain from a closed-loop economy, circularity seems to have our 'thumbs up' in principle. The truth is however, we are a far cry from adopting its practical reality in our design-distribution streams. So how will we get there? If the circular economy is indeed the way of the future, what needs to change now to usher it in? Could the circular economy define the end of the extractive industry as we know it?

Adidas has launched a three-year materials research initiative called Sport Infinity, which seeks to create a more efficient way of recycling sportswear.

We have to believe in a new buying power

The Kingfisher Group has much to say on the future shift in consumerism, and they're using power tools to say it. Rather than buying that drill that is used on average six minutes in a year, why not rent it for the day? Surely it would be better value for money on that rare occasion when a hinge is loose? Their company, along with others like Mud Jeans and Philips, are paving the way for new ideology and design around products and how we relate to them. Consumerism is moving to stewardship, with the emphasis on service over product acquisition. So, in other words, the 'pay per use' contractual agreements associated with smartphones could extend to washing machines, DIY equipment or even Levi jeans. Access, not ownership, to a product will be the new trading power. This will launch fantastic new intelligent systems to undergird the process. But it will firstly require a good deal of unlearning and open-mindedness for us who have been immersed in linear thinking.

We have to up our game

Within the former linear structure, sales were the success markers. Manufacturing and design simply had to align just enough to make the product sparkle, shine and ultimately sell. They didn't have to consider the total fossil fuel emission of production or its biodegradability in landfill. The product's recyclability was not in question. It was only the swipe of the credit card.

A circular economy, however, is really complex. It accounts for a product's entire life cycle in its design. Systems-level redesign and skills we haven't yet imagined will be

needed in order to recall, repair and reincarnate products into an upgraded former self. Rapid innovation will generate IoT platforms and seamless technologies into new services and product offerings. The need for ongoing research and development will drive STEM (Science, Technology, Engineering, Mathematics) disciplines. We need to prepare for these complexities, so that the added layers of life cycles are anticipated in tomorrow's briefs and an 'egg-on-face' situation is narrowly averted.

We have to collaborate

Circular solutions will only realise sustainable, future-proofed ecosystems if everybody is on board. Perhaps even more important than the engineers and designers, governance and regulation are crucial in endorsing these processes. Redesigning supply chains and business models require robust round-table discussions between businesses, universities, social groups and policymakers.

Initiatives such as the Ellen MacArthur Foundation's Circular Economy 100 embraces this idea that closed-loop ambitions can never be achieved by working in isolation. This group ties together supply chain leaders, industries and geographies. From designers to academics, CEOs to city mayors, people are locking heads and sharing their complementary expertise. The result of which is a more effective and holistic solution that generates wins for both the planet and our pockets.

Linear thinking can't meet the needs of the emerging circular economy. However, all is not lost. Draw a straight line long enough and it would actually envelop the globe, paradoxically making a circle. What we need are linear thinkers to be open-minded to extrapolate their thinking out far enough in order to, ultimately, draw the same conclusion – that a circular approach is actually where all roads lead. Going forward, drawing circles around our consumer behaviour may be the best way to draw the line. ❑

The original article by Tim Plenderleith, Client Director – manufacturing, ANZ & Asia, Aurecon, was published online and can be accessed by clicking the QR code opposite.

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N-series shear speeds-up metal recycling

Texas-based metal recycling company, Oak Cliff Recycling, has selected Metso's N-series inclined shear (NIS) to maximise metal processing efficiency.

"Metso's NIS can process difficult materials quickly and efficiently. Cutting cycle times are fast, and the design of the moving floor in getting the scrap metal to the blades removes the added time of folding and compressing in a box," says Benjie Smith, owner, Oak Cliff Recycling.

The Texan recycling company has struggled with unwieldy materials in conventional style shears that slow down production. Oversized and often intractable material hampered recycling processes, but the challenges were detected and solved with the help of Metso experts.

The Metso NIS is a state-of-the-art gravity feed shear that can accept long material and large bulky scrap and is available with cutting forces from 600 to 1 250 t. Self-contained and easy to install, the unit offers exceptional performance on heavy-melt scrap, auto bodies, steel mill scrap, miscellaneous shapes, pipe, plate, shipbreaking, railcar, demolition scrap, aluminium, and stainless steel materials.

Regardless of the size of business, big or small, the NIS is at the forefront of providing the technology and services needed to ensure success. The N-series range is fully backed by Metso's worldwide service network. Service contacts are locally available to customers so that they have efficient direct support when required.

New housing design for Lindemann shredders

Metso has developed a new housing design that cuts service downtime, facilitates the maintenance of recycling equipment and makes it easier to keep the machinery in top shape. Available for almost every Metso Lindemann™ shredder, the new solution enables multiple maintenance operations to be performed conveniently, swiftly and at one time.

The most significant improvement is the detachable front wall. The removable unit provides easier access to wear parts and speeds up the replacement of worn components.The new design also enables several maintenance tasks to be carried out at the same time. With the detachable front wall lifted out of position with a crane, the rotor adjustment and the replacement of wear plates, for example, can be conveniently handled simultaneously.

Minimising maintenance downtime in production is achievable by acquiring a second Metso front wall set for stock. This makes it possible to replace the whole front wall and its worn parts immediately, so that production can be restarted without delay. All the required maintenance for the dismantled set can then be done while production is up and running so that it is ready for the next service break.

The solution is available as a retrofit for existing middle housings, as part of a complete new middle housing, or as standard for all new Metso Lindemann machines. ❑

The Metso NIS is a state-of-the-art gravity feed shear that can accept long material and large bulky scrap and is available with cutting forces from 600 to 1 250 t.

Environmental sustainability through resource recycling

PFE International performs well in tough economic conditions in 2016 and foresees increased market share this year.

PFE International remained focused on its long-term strategy during 2016 in a stagnated South African economy and a business climate with little or no sign of an upturn on the horizon.

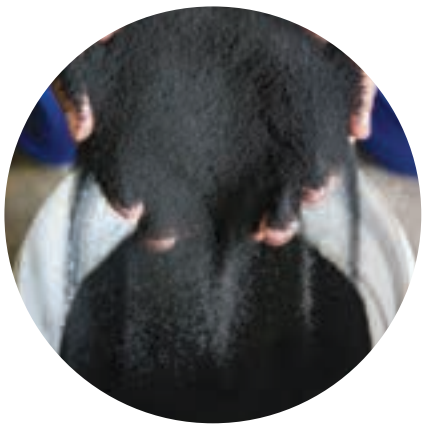
This is according to Mehran Zarrebini, CEO of the group of companies which includes Van Dyck Carpets, Easigrass, tyre recyclers Mathe Group, polypropylene staple fibre producer PFE Extrusion and Envirobuild, manufacturers of eco-friendly rubber flooring.

"Despite difficult trading conditions, our companies performed well this year through balancing operational risk with financial risk," he said.

"Recent economic data and monthly indicators point to expectations of little or no significant recovery in 2017. Growth remains a particular concern for South Africa coupled with high levels of unemployment, political turmoil and a lack of investor confidence. Whilst the country managed to steer clear of a ratings downgrade in 2016, it is still uncertain whether the country can continue to navigate through this headwind during the course of this year.

"As a family-owned entity with a turnover of more than R600-million, we are cost-and risk-conscious. We scrutinise investments and expansion plans whilst remaining committed to South Africa and to further investment in our diversified portfolio of companies. We continuously aim to manage and position the group for the long term."

Looking back on 2016, Zarrebini said that load shedding had had a significant impact on the group's operations. "Our extrusion facilities were severely affected due to operational requirements with respect to heating. This resulted in decreased output. Fortunately, as the load shedding subsided, it was possible to meet customer requirements," he said.



The Mathe Group's new waste tyre processing facility led to investment in new machinery at Envirobuild for the manufacture of commercial rubber flooring from rubber crumb.

Being an organisation that trades internationally, PFE was also at the mercy of exchange rate fluctuations. "Our focus is on the production and manufacture of raw materials and products and not in hedging currencies. Whilst various options are at our disposal to mitigate currency risk, including forward contracts and managing currency exposure through business practices, our approach has been one of prudence and risk minimisation. There is just too much uncertainty and volatility to successfully employ any particular method," Zarrebini said.

PFE invested in significant capital projects during 2016 – in the installation and commissioning of new machinery as well as in upgrading processes and improving efficiencies.

Mathe Group saw the largest investment – in a new tyre facility commissioned in February, which has now processed more than 100 000 truck tyres. "We expect increased off take this year as we secure new clients in different industries and look forward to becoming the leading processor of waste tyres in South Africa," Zarrebini said.

"The new waste tyre processing facility led to investment in new machinery at Envirobuild for the manufacture of commercial rubber flooring from Mathe Group's rubber crumb. Further investment is planned in the use of rubber crumb for the manufacture of novel and innovative new products.

"Because the industry is still in its infancy in South Africa, our focus will then shift towards activities such as educating professionals and potential future consumers about the benefits of using these products."

Polypropylene staple fibre producer, PFE Extrusion, also saw investment in new technology last year. "This was necessary to remain internationally competitive with a strong emphasis on incorporating resource efficiency and resource reduction into the manufacture of the different products," Zarrebini said.

"Over the past few years we have seen supplies of raw materials become scarcer, and thus more expensive. They are also subject to price volatility. Our focus remains an opportunistic one as we continue our journey to transform our operations and increase resource productivity and rethink our business model to capture value residing in resource ownership."

He added that he believed the minimisation of resource usage would continue to unlock significant value whilst establishing greater operational stability throughout the group.

Zarrebini is very optimistic about the group's artificial grass brand, Easigrass, which continues to grow and excel as drought, maintenance and environmental factors increase preference for the installation of artificial grass, both for landscaping and commercial purposes.

"With Easigrass, we have a strong emphasis on lead generation through digital and social media advertising, which our partner network can leverage," he explained. "This network is expanding steadily and is expected to continue throughout 2017 both locally in South Africa and internationally in the SADC region."

Zarrebini envisages further increases in market share with various product categories. "The demand for recycled rubber paving products is expected to increase as consumers and business clients source products with enhanced green credentials. We expect growth to continue throughout the year as we add further capacity to our production."

In the flooring segment, he foresees increased growth for their resilient and hard flooring products this year, including luxury vinyl tile (LVT) planks in different sizes and colours, water-resistant laminate flooring and "our more recently launched woven vinyl tiles".

"We have also expanded our range of commercial and residential flooring options and will launch new products later this year.

"We remain focused on being at the forefront of environmental sustainability in South Africa in the industries in which we operate," he concluded. ❑

SA's next generation litter picker

Increasing pressure on city environments has led broom, picker and refuse pushcarts to give way to more compact, electrically operated, zero-emission cleaning equipment.

Goscor Cleaning Equipment (GCE) of Johannesburg is introducing the latest cleaning equipment technology into the Southern African market with its launch of the GM1ze from Green Machines International. "This compact sweeper not only saves time thanks to its powerful battery, but is also easy to operate, and enhances hygiene, safety, and environmental awareness," says GCE general manager, Greg Venter.

The latter is particularly important in an urban context, with towns and cities struggling with respirable dust and exhaust emission limits, all in an effort to reduce carbon dioxide emissions. "The GM1ze is the latest 'green' e-sweeper, representing the best of German engineering excellence," Venter adds.

The special narrow design – 780 mm wide, 1 480 mm long and 1 760 mm high – means that the GM1ze is ideal for use in confined spaces. Double soundproofing is standard, with an acoustic level approaching that of absolute silence.

It uses 24 V, 36 V or 48 V lead acid batteries, giving it an eight- to 16-hour operating window, depending on the application. The machine is powered by a 0.85 kW motor – an electric axle with a permanent magnet dc motor and integrated parking brake – and produces 1.5 kW of suction power from a brushless dc motor. It has an 18 m^2 dust filter, and a suction pressure of about 25 mbar.

The GM1ze's water system consists of an electric water pump and an intermittent water spray nozzle with a 10 ℓ water tank. The mounted 125 mm diameter suction pipe features an anti-clogging grid to prevent blockage by debris such as plastic bags, paper, and leaves. Made from lightweight fibreglass, this pipe weighs less than 1.5 kg.

Additional features include puncture-proof tyres and shielded ball bearings, a front steering wheel, an ambidextrous control arm for right- and left-handed operators, together with an automatic dead man position, a battery charge level gauge, and a timer for the suction and traction motor.

An automatic parking brake facilitates parking, even on steep slopes, while there is an emergency stop switch on the dashboard for enhanced safety.

Green Machines is part of the long list of leading international brands distributed by GCE, which includes well-known names such as Tennant, Ghibli, Maer, Delfin, Elgin, Macro, and High Point. "It is important for us to be associated only with the top brands, as reliability and performance are key to the total cleaning solutions we offer our customers," Venter says.

"We strive to remain at the leading edge of international cleaning trends. In this regard, the zero emission and low noise features of the Green Machine equipment will definitely set a new benchmark in the Southern African cleaning industry," he concludes. ❑

Aerator drives and the single source advantage

The supply of ten SEW-Eurodrive DRN IEC motors with MC-series gearboxes for the aerators at a local wastewater treatment plant represents the first project success for the company's new IE3-rated motors since their release into South Africa last year. *MechChem Africa* talks to head of projects, Rudi Swanepoel.

SEW-Eurodrive has recently completed a delivery of ten customised aerator drive systems destined for a wastewater treatment plant being upgraded in Meyerton. "Springing from our core agitator gearbox business, we were approached by an OEM for wastewater treatment, management systems and services that was handling the upgrade on behalf of the water board," says Swanepoel.

Having designed the wet-end of the aeration system, the OEM contracted SEW-Eurodrive for the supply of the drive ends of these systems, each consisting of a vertically hung MC-series gearbox coupled to a DRN IEC motor.

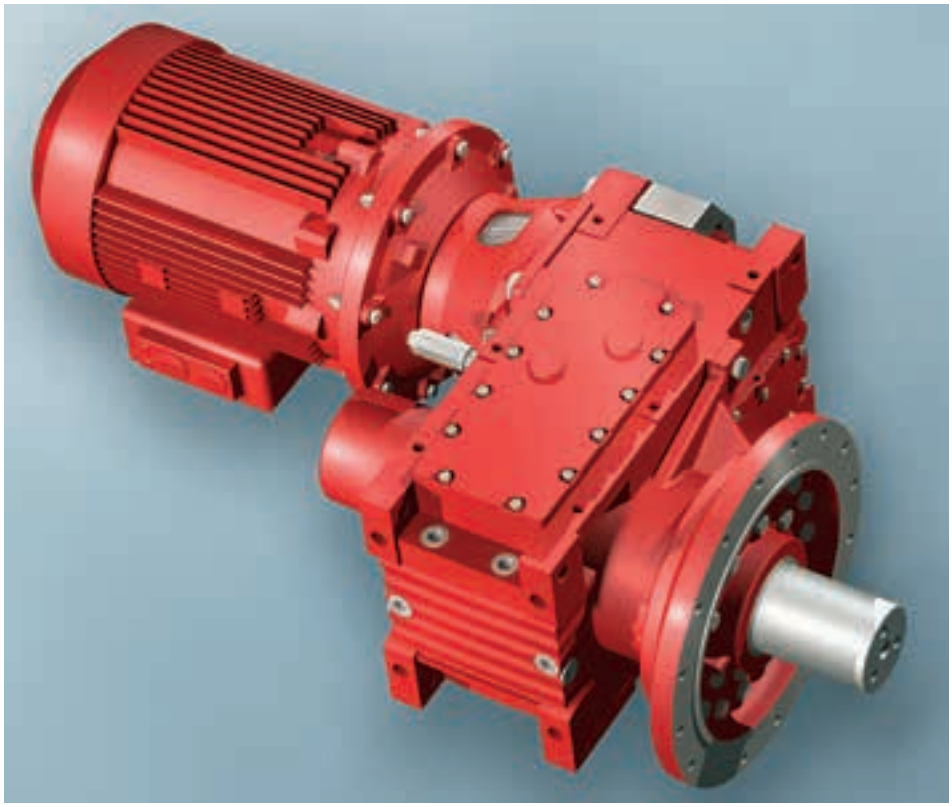
Aeration is the critical stage of the activated sludge treatment process, a process that oxidises biological matter and removes nutrients such as nitrogen and phosphorus. Aeration supplies the oxygen required to accelerate sludge activation. "Simply put, an impeller is used to churn up the surface and bubble air into the wastewater," Swanepoel explains.

Surface aerator impeller vanes are used to pull wastewater up from the tank and discharge it horizontally outside of the impeller rim. A liquid plume is created that maximises the contact area between the air and the water, causing air and oxygen to be continuously mixed, dissolved and circulated through the wastewater being treated.

"We supplied gearboxes from our mixer and agitator (MC) range, coupled to the motors. Ten drive systems in total were supplied, six with 45 kW DRN IEC motors and four with 55 kW motors," Swanepoel says.

The MC gearbox range is purpose built for mixing, agitating and aerating applications. "Our portfolio of high-torque and robust industrial gear units is designed to meet the most rigorous torque and shock-loading requirements," says Swanepoel.

Large axial and radial forces occur along the impeller shaft during these processes and SEW-Eurodrive has overcome this problem with its extended bearing distance (EBD) design. This extends the life of the bearings within the gearbox and prevents the need for oversized gearboxes or additional support bearings.



SEW-Eurodrive recently supplied ten of its DRN IEC motors directly coupled to MC-series gearboxes for the aerators at a local wastewater treatment plant.

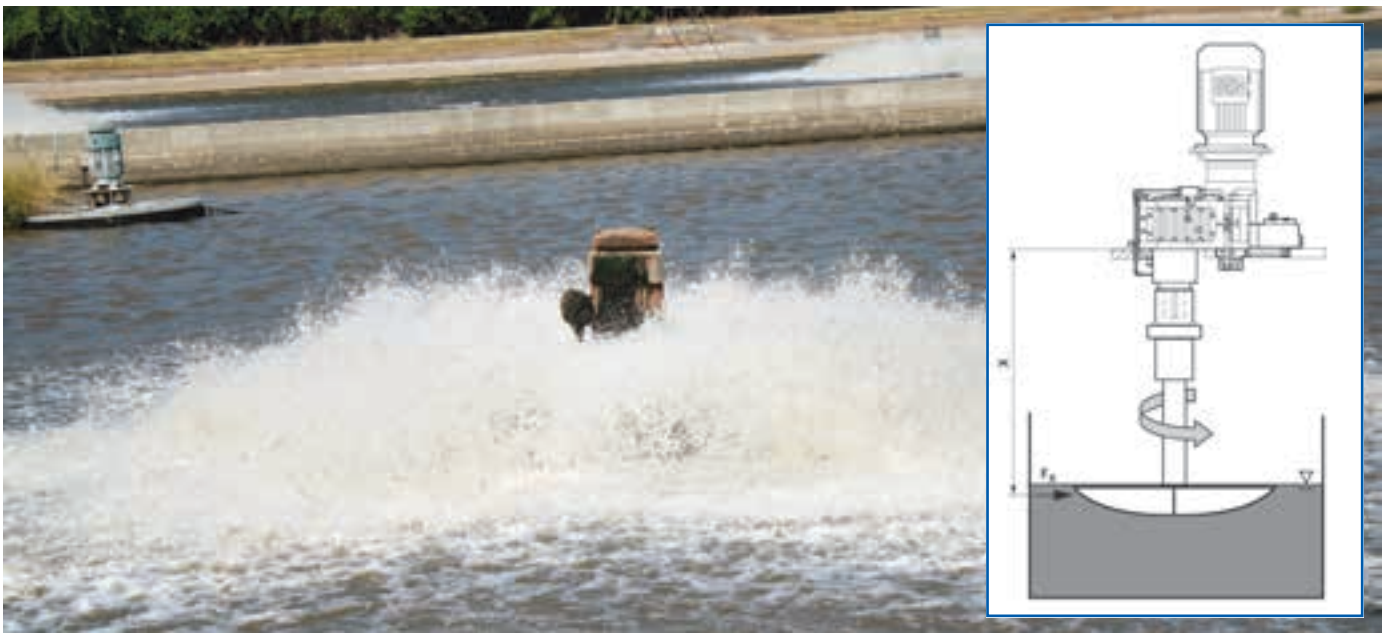
"We design our gearboxes for a bearing life of 100 000 hours, which is just short of 10 years of operation. Thermal ratings are also excellent. We don't get overheating, particularly on the MC range, even under high ambient temperatures," Swanepoel adds.

For surface aeration applications the MC gearbox is installed vertically above the tank, but for mixing or agitation use, these units can also be installed horizontally (on the side of the tank) or under the tank in special cases, and both left and right output shaft positions are possible.

SEW-Eurodrive uses a calculation program designed specifically to select a gearbox suitable for the application. "We use this program to determine whether a gearbox selection is adequate, based on the calculated torques, loads and bending moments. This is particularly important when it comes to aerators and mixers. So these are not off-the-shelf products, but have been selected specifically for the system in question," he says.

Swanepoel tells *MechChem Africa* about gear ratios used for the Meyerton aeration project: "The 45 kW units are fitted with a gearbox with a 32.22 reduction to rotate the impeller at around 46 rpm from the four pole, 1 470 rpm asynchronous motor speed," Swanepoel responds, adding that the more powerful 55 kW units turn the impeller a little slower at 41 rpm from a higher ratio gearbox (35.78).

"The impeller speeds and gearbox torques are all very carefully selected so that the impellers can continuously supply the optimum quantity of oxygen to the process. Too little oxygen slows the



Surface aerator impeller vanes are used to pull wastewater up from the tank and discharge it horizontally outside of the impeller rim. Air and oxygen are continuously mixed, dissolved and circulated through the wastewater being treated. Inset: a layout diagram of the Meyerton aeration systems.

biological activation process and too much is a waste of energy," he says.

Reducing energy consumption is the key reason for choosing the new DRN IE3 motors for this application. "This is the first supply of these motors into a big project in South Africa. These are IE3, premium efficiency asynchronous motors, which offer energy efficiency advantages over previous-generation standard efficiency (IE2) motors, which are being phased out in many parts of the world," says Swanepoel.

In the European Union (EU), all two-, four- and six-pole asynchronous motors with power ratings of 7.5 to 375 kW must now meet the requirements of the IE3 energy-efficiency class. "While South Africa does not face the same regulatory pressure, we have decided to raise the benchmark by making the DRN series our standard offering here too," he points out.

The single source advantage

"Having long been one of the preferred gearbox suppliers for mixing and aeration applications in the water industry, our ability to couple our gearboxes with our own premium efficiency motors means that there is no longer a need to have multiple suppliers and warranties to cover the drive-end of these systems," Swanepoel suggests.

"We can now supply complete systems with a single warranty and a common service agreement – all because of our new DRN motor offering," he tells .

By meeting the IE3 efficiency standards, customers can be assured that these motors are as efficient as any premium efficiency motors made anywhere in the world, and they also comply to German DIN motor specifications, which is among the most rigorous of quality standards.

Other key features include a compact and modular design, making these motors exceptionally easy to couple to both new and legacy SEW-Eurodrive gearboxes. "We have local stock holding and service capability and the range covers applications all the way from 0.75 to 315 kW in voltages from 240 to 690 Vac," he adds.

While the DRN range has been launched with competitive pricing in comparison to competing premium efficiency alternatives, the real price advantage, according to Swanepoel, comes because of the ability to quote the complete drive-train systems, including any SEW gearbox, DRN motors and, where required, SEW VSDs too. A whole system price can be significantly less expensive than a solution involving several different suppliers," he notes.

SEW is increasingly moving towards offering holistic solutions: "Take a ball mill in the minerals processing sector, for example. We can supply the drive gearbox from our X-series industrial gear unit range, a DRN motor with a VSD to control the speed. We can now also supply the girth gear, itself, so the design, installation, servicing and maintenance of an entire mill drive system can be supplied from SEW-Eurodrive as a single-source solution," Swanepoel points out.

Returning to the additional customisation work for these aerator systems, he says that the units also had to be customised with instrumentation specified by the client. Oil flow switches were fitted to manage the lubrication pumps. "The MC range is fitted with a mechanical shaft-end pump that is mounted underneath the gearbox to circulate the oil back up." Hence the reason for fitting the flow switches. These are necessary because the boxes are hanging vertically, so the oil has to be circulated back up to the top bearing. Splash lubrication is inadequate in these situations.

The motors were fitted with high accuracy PT100 temperature sensors, which send temperature data back to the controller for continuous temperature monitoring; and thermostat-based motor protection that cuts out internally when dangerously high temperatures are being experienced.

"Strip anti-condensation heaters were also incorporated to protect the motors from damp, along with rain canopies to protect the systems from the worst of the weather. All of the equipment being used is IP65 rated – 100% protection against dust ingress and low pressure sprayed water."

"We succeeded in meeting all the delivery dates and we now have the common stock in South Africa, so going forward, we will be able to customise any motors with these additional features here in South Africa.

Concluding, Swanepoel says that SEW-Eurodrive's mixer, agitator and aerator systems' offering is now much stronger. "From a quotation and selection point of view, we do our own calculations based on any client application and recommend an optimum drive solution – one that is competitively priced with a single warranty from a single service provider.

"We offer German quality solutions at lifecycle costs that will be difficult to beat," he says. ❑

Up the uptime with high quality products

Hudaco company component, equipment and system specialist, Powermite, is a leader in the southern African market in the supply of a fully comprehensive range of high quality, locally manufactured, electrical products for a wide range of mining, marine and industrial machinery comprising mobile generators, pumps, welding machines, continuous miners, shuttle cars, tunnel borers, and transformers.

According to Powermite's marketing director, Donovan Marks, quality and reliability are prerequisites for extending the lifecycle of products operating in the notoriously stringent mining environment. "Increased product lifecycle goes hand in hand with optimised uptime and productivity, thus quality therefore takes centre stage when it comes to our range of electrical products and components."

Powermite's ISO 9001:2008-compliant electrical products are manufactured locally by sister companies, Proof Engineering and Ampco, under one roof in a new, advanced manufacturing facility on Johannesburg's West Rand. Both companies carry SABS approval to IEC 60079 Part 1 and 2, and SANS 1489 – 2005, and to 60309 Part 1 and 2 respectively.

"Pooling the talents and resources across both businesses has created the largest plug and socket manufacturer under one roof in Africa," states Marks. "In addition to lowering our cost base, combining the strengths and synergies of the two companies has improved efficiencies across the board and has resulted in more streamlined processes and logistics.

Proof Engineering is a flame- and explosion-proof product specialist with over 45 years' experience in the manufacture of world class components, equipment and systems for southern African industries. The company produces PLM366 and PLM415/515 plugs and sockets as well as an 11 kV, 800 A tunnel coupler and adaptor for open cast applications, 22 kV 400 A couplers for draglines. More recent additions include a new 35 kV, 400 A coupler and adaptor for overhead line skids. An extensive series of plugs, sockets, couplers and adaptors, is also available from Proof, for underground equipment. The company's unique phase-to-phase segregation eliminates the risk of faults which can cause costly downtime and lead to serious injury to personnel.

Powermite produces PLM 366 and PLM 415/515 plugs and sockets.

Another innovation from Proof Engineering is the unique ProAlloy coupler. Manufactured from a non-theft zinc, copper and aluminium combination material, the coupler is a remarkable 33% lighter than its brass counterpart and perhaps more importantly, holds no resale value. "The subsequent reduction in theft risk lowers the potential for unplanned downtime and subsequent production losses," explains Marks.

Available from the Ampco stable are plugs and sockets suitable for certain underground operations. The company also manufactures a range of products that focuses primarily on industrial applications and is ideally suited for mobile generators, pumps, welding machines, and factory installations, for example.

www.powermite.co.za

Floor grating must be well engineered

Walkways can be aptly described as the 'arteries' of most minerals beneficiation and industrial plants, providing functional access while bearing substantial loads and allowing air and light into working areas. It is essential that the floor grating used for such walkways be well engineered to ensure long life and optimum safety for users.

Leading local floor grating manufacturer Andrew Mentis operates an extensive facility that produces significant volumes of its RS40 Rectagrid, which has long been the benchmark for walkways in southern Africa.

Elaine van Rooyen, marketing manager at Andrew Mentis, says that apart from supplying a standard floor grating product, the company is also able to provide a fit-for-purpose floor grating solution based on customers' requirements.

"A technical representative from Andrew Mentis meets with customers to determine their precise needs and ensure that the structural integrity of the chosen product is maximised," she explains.

"While taking into account the customer's application needs, there are specific non-negotiable factors that Andrew Mentis applies in the production of all its floor grating products," she says. "The manufacturing method we use, for instance, ensures that the transversals are positively and permanently locked to the bearer bars."

Mentis Rectagrid RS40 floor grating has proved itself over years of application in the construction and mining sectors.

The locking method is based on compressive pressure at the intersections, engineered to use the full depth of the bearer bar. The grating panels – with a pitch of 40 mm by 40 mm – are flat, square and untwisted, so there are no cracks or crevices at intersections where corrosion could take place.

"We undertake all manufacturing at our world class facility in Elandsfontein near Johannesburg, where the most stringent standards are applied," Van Rooyen says. "These quality processes allow the combination of high load-bearing capacity with a low relative quantity of metal. Filler bars distribute the load and stiffen the construction, while supporting bars take the load and transmit it to the bearing support."

Andrew Mentis' RS40 floor grating is engineered to take a specific loading, ensuring the safety of people walking or working on mezzanines, catwalks, platforms and ramps. The grating's non-slip characteristics are created by the positive raised sections that produce multi-directional obstructions on the top of each bearer bar, allowing for a far larger surface contact area.

www.mentis.co.za

New synchronous alternators and PM and PTO generators

New to Vert Energy's range of electric power generation (EPG) components are NSM synchronous alternators, welding sets, permanent magnet generators (PMG) and PTO generators that provide reliable, clean and stable power.

"Vert Energy's standby and power solutions' service to generator-set builders encompasses an extensive range of dependable EPG components for general industry and the mines, as well as commercial and industrial sectors," says Ryan Robertson, director, Vert Energy. "These solutions focus on areas that are off-grid and for industries where power supply isn't constant, or reliable.

"The company's product portfolio, which is extended on an ongoing basis to meet exact market demand, now includes NSM 2 pole, 3 000 rpm alternators, from 2.2 kVA to 22 kVA in 220 V and 380 V supply versions.

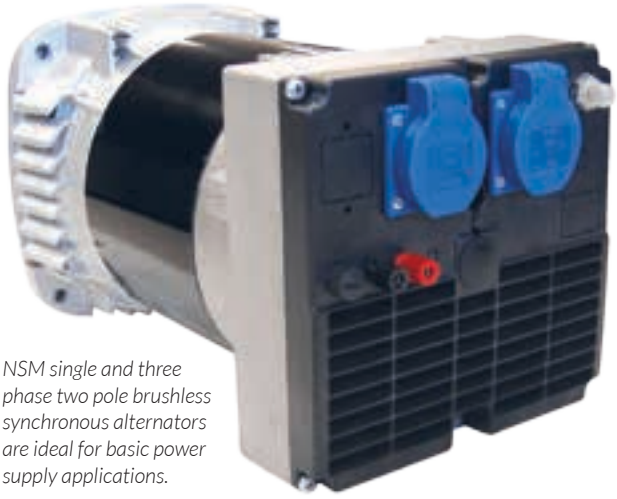
"We have identified a growing need for dependable portable power, particularly for use in agriculture and mining applications, amongst others. "Portable generators are not only essential in the event of a power outage, but are also useful in remote places where conventional power is unavailable."

NSM single and three phase two pole brushless synchronous alternators with a capacitor are suitable for basic power supply applications. For more complex applications, for example, units with electronics such as UPS systems, single and three phase two pole brush synchronous alternators with automatic voltage regulators (AVR) are recommended. AVR units ensure voltage regulation is consistent, which is critical for units that are sensitive to voltage ripples and spikes.

The compact PMG-GS system for generating sets consists of a permanent magnet generator, a single phase inverter with an EMC filter and a regulation kit for engine revolutions control. This control system ensures a constant inverter output voltage if load variations occur. Engine performance is optimised and speed is adjusted according to the output load, reducing fuel consumption and lowering noise levels.

NSM has also launched a new range of permanent magnet generators (PMG) for micro wind energy production. Features for high performance and low cogging ensure the wind turbine spins, even with minimum wind speed. This range supplies continuous output power from 0.5 to 6.0 kVA with a high overload capacity for a limited time span.

A critical part of Vert Energy's service to ensure dependable power generation is the availability throughout Africa of factory- and OEM-trained technicians who cope efficiently with any electro-mechanical breakdown situation or routine preventative maintenance procedures. ***www.vertgroup.co.za***



NSM single and three phase two pole brushless synchronous alternators are ideal for basic power supply applications.

A built-to-last relative humidity sensor

Michell Instruments, represented locally by Instrotech, has on offer its new HygroSmart HS3 sensor, now with I2C communications protocol/slave device (BUS output), that supports a maximum speed of 100 kHz. Each slave on the I2C bus holds an individual 7-bit device address. The address byte is then followed by the op-code and eventually the payload.

Because it has been designed to withstand the kind of harsh and demanding conditions found in industrial processes, the HygroSmart HS3 sensor has a polymer tile to give long-term reliable measurements. In addition, it also has an accuracy of 0.8% RH, making it among the most accurate and reliable RH sensors on the market. It also allows for longer recalibration periods, which not only gives peace of mind to process operators, but also provides a low lifetime cost of ownership when compared to disposable sensors.

Also available is the complete HygroSmart HS3 probe which consists of a solid, corrosion-resistant probe body with an interchangeable sensor. The probe offers voltage outputs of 0-1 V, 0-2.5 V, 0-5 V, 0-10 V and a Modbus RTU digital output signal over RS485 2-wire. When recalibration is due, the old HygroSmart HS3 sensor is simply exchanged for a new, freshly calibrated one. This simple procedure takes only a few seconds to carry out, with the probe itself remaining installed.

In most industrial applications, RH probes have to withstand vibration, exposure to water, occasional heavy shocks and high levels of electrical interference. The HygroSmart HS3 body is designed to cope with all these environmental factors. As well as the solid body, the probe also has a 10 bar pressure rating, rfi/emc electrical noise approvals and an IP67 ingress protection rating.

The HygroSmart HS3 probe also gives control to the user, as it is 100% configurable, giving users the ability to alter their RH and temperature measurements.

www.instrotech.co.za

Turnkey solution of new generation seals

SKF South Africa provided a turnkey solution in order to assist an OEM customer to reduce lead times and streamline planned downtime.

In addition to the long lead times on seals for their underground earthmoving equipment, the customer was also unhappy with general service delivery from its supplier and decided to look for a single source supplier. The logical step was to approach SKF as the customer was already using SKF bearings and happy with its service delivery.

SKF's OEM division suggested the Speedi-Sleeve as the best sealing solution for the earthmoving equipment. The new generation Speedi-Sleeve, developed by SKF, uses a proprietary stainless steel material and manufacturing process that gives an optimised seal counter-face surface which minimises wear on both the sleeve and sealing lip. The contact surface is wear-resistant. Imperceptible lubricant pockets enable the lubricant to reside on the sleeve and thereby prevent dry running of the sealing lip that otherwise can create excessive wear.

The thin-walled Speedi-Sleeve is simply pushed in position over the worn area. There is no shaft disassembly or machining involved, minimising costly downtime. Furthermore, since the installation tool is supplied with the sleeve, no special equipment is required to fit the seals.

In addition to supplying the Speedi-Sleeves, SKF also provided product training, assisted with planning of downtime to replace worn seals and helped the customer to achieve the goal of reducing its supplier and vendor lists.

The customer expressed great satisfaction as now it conveniently deals with a single source supplier for both seals and bearings. SKF's professional and expedient service also impressed the customer; SKF sales representatives assisted with back orders and continue to hold regular planning meetings to ensure that the correct products are on the customer's shelves.

www.skf.co.za

Standby power solution for Ghana Airports Company

Cummins Power Generation has provided a standby power solution to provide back-up power for Ghana's six major airports. This major turnkey project was undertaken on behalf of main client Ghana Airports Company Limited of Accra. The back-up power will support air transportation systems in Accra, Tamale, Suyani, and Kumasi, Ho and Wa.

An end-to-end solution was provided to meet the particular requirements of this major new customer for Cummins Power Generation. Alfred Otoo, project manager for Cummins Ghana comments: "Our role was comprehensive, from compiling the tender package for the project all the way through to supervising the installation, commissioning, and handing over."

The scope of supply for this prestigious project was a C1100 D5, four C500 D5, and two C450 D5 units. In addition, Cummins Power Generation supplied 1 600 A ACB, four GTEC 800 A transfer switches, and four GTEC 630 A transfer switches.

Ghana Airports Company Limited also specified low noise levels, which meant Cummins Power Generation had to pay special attention to the ambient environment. Another challenge associated with this project was adhering to the strict timelines of the various airports, which meant that installation could only be carried out when air traffic was low, usually between 01:00 and 04:00 am.

"We could not interfere with anything in terms of potentially switching off any live system. In addition, we had an exceptionally narrow window of opportunity, when air traffic was minimal, for us to execute the project," Otoo says.

He concludes that this flagship project was an excellent showcase for the Cummins brand, which extended beyond simply supplying products to actually adding value to the client's business. "We managed the entire project, right from the initial contract win, resulting in the best possible solution for our client, in the shortest timeframe possible."

www.cummins.com

Safety-helmet suspensions improve comfort

Painful compression headaches due to safety helmets that do not fit properly are now a thing of the past thanks to flush suspension tabs on the latest MSA Fas-Trac® III ratchet suspensions, available from MSA Africa for its V-Gard range of safety helmets.

The latest suspensions can be ordered pre-fitted on any MSA V-Gard helmet, or as spares. "We have made it 'painless' for customers to standardise on these new suspensions as there is no change in part numbers for complete helmet assemblies. MSA Fas-Trac III is the answer to everyone's safety-helmet requirements," Suraksha Mohun, product marketing manager, MSA Africa, comments.

In addition, two different sweatband options are available, depending on application or preference. These are PVC, perforated wipeable or sweat-wicking and replaceable foam, which is also machine-washable. The foam sweatband is made from breathable fabric for direct air permeation. MSA Fas-Trac III boasts the largest sweatband surface area on any safety helmet, which improves perspiration absorption by covering more of the headband and the wearer's forehead.

"Extensive customer research has revealed that the MSA Fas-Trac III wheel-ratchet suspension is preferred by most users over what they are currently wearing," Mohun continues. "This is because of the main benefits of improved helmet comfort, retention and stability, with the added advantage of easy single-handed adjustment."

The premium MSA Fas-Trac III suspension also comes with a lower nape strap than any other protection helmet suspension, which improves balance and means that the safety helmet stays on when the wearer leans over.

Separating the ratchet from the neck also allows the comfort pad to cradle the wearer's head, increasing air flow. The ratchet has a smooth rotation and an easy-grip knob that can be adjusted even when the user is wearing gloves. Superior nape fit and compatibility with other personal protective equipment is ensured by three levels of height adjustment.

MSA Fas-Trac III suspensions are available for all V-Gard industrial safety helmets from MSA Africa. ***www.za.msasafety.com***

Afrivalve's new premises

Afrivalve, the specialist sales division of the eDART Group, recently moved into new, improved and expanded premises. The continued growth in sales and extended range of valves supplied by Afrivalve made the move into larger premises a necessity.

Gregor Hopton, group marketing manager for Afrivalve comments: "In the past 18 months, Afrivalve has been engaged in more project work, which led us to look for premises that could accommodate our operations and stock holding. As we are now selling a greater number of large diameter knifegate valves (up to DN800), space became more of a priority, and we believe our new facilities in Kya Sands, Randburg, will fit our sales and manufacturing requirements."

"Our new premises will give us the ability to centralise our sales team and to assemble the C-Tech Knifegate and RedRoc Pinch valves that are currently manufactured at eDART's facility in Jet Park, east of Johannesburg. We are very excited about our expansion, as it means we can service and supply our clients even more smoothly and efficiently," concludes Hopton.

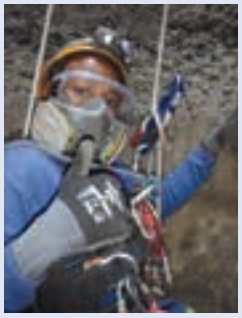
Afrivalve was launched in 2015 in order to further expand the eDART range of products so that complete packages could be offered and thus new markets captured. Afrivalve recently became the official distributor of the Gemü Valve and Control Systems range for the mining and metal refining sector in Africa.

www.afrivalve.co.za

Access specialist boosts workforce

The increase in workers is a sure-fire indication of sustained growth at the rope-access specialist, Skyriders, which still derives 75% of its workload from the South African market.

"The majority of our targets that we set for the business were met and, in a few cases, exceeded. Our focus going forward in 2017 will be to consolidate what we achieved during the latter stage of 2016," says Skyriders marketing manager, Mike Zinn.



Rapid rigging and derigging.

Electricity utility Eskom remains a major client, with Skyriders enjoying an ongoing scope of work at both Medupi and Kusile Power Stations, as well as at the Ingula Pumped Storage Scheme. Another major source of repeat work has been various projects for Sasol.

The big challenge for Skyriders in previous years has been the quiet winter months, during which time there is little opportunity to undertake any regular maintenance work at the power utility. This trend was finally broken in 2016, with an extremely busy winter for all Skyriders' clients.

"New and old clients are experimenting with our alternate access service offering in order to assist with their maintenance budgets, which are being stretched further as cost-cutting and lacklustre economic growth bites," Zinn explains.

Skyriders offers a variety of rope-access aided services to numerous industries, such as power generation, petrochemical, mining, heavy industry and facilities management. Current services include non-destructive testing (NDT) and inspection, concrete inspection, maintenance and repairs, application of coating systems, working-at-height safety systems, welding, and confined-space rescue and standby.

www.ropeaccess.co.za

Fuel cells, greener genset and FCEVs

Implats has established a fuel cell project with the ultimate aim of taking its Impala Platinum Refinery off the Eskom grid. *Peter Middleton* takes a look at the expanding range of applications for fuel cells in a greener economy.

On February 7, 2017, platinum group metals producer, Implats, announced its intention to take its Impala Platinum Refinery off the Eskom grid, initially with the installation of an 8.0 MW Doosan fuel cell bank.

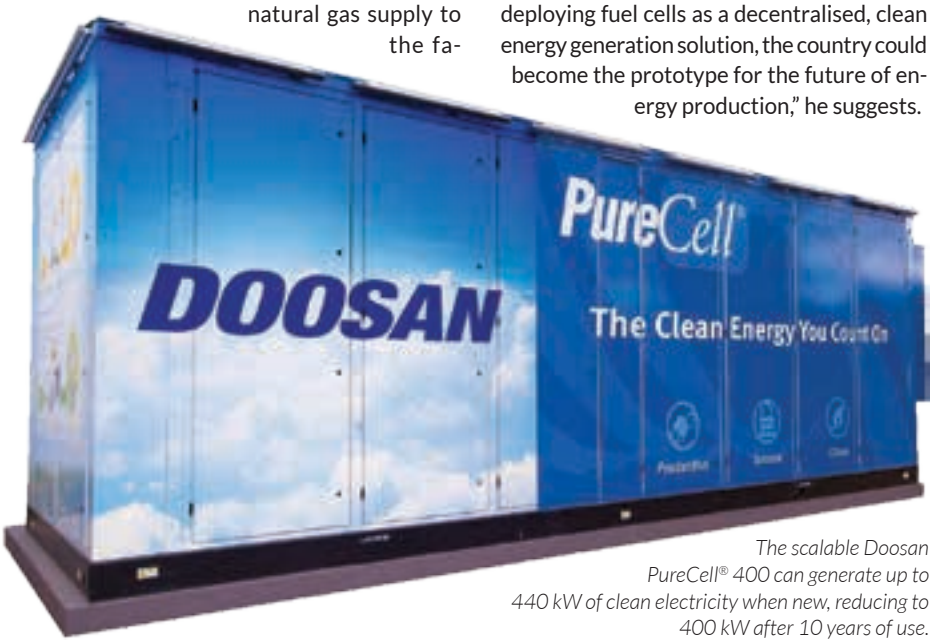
The project is already at an advanced development stage with Doosan Fuel Cell America (Doosan) as the technology partner; an agreement imminent with an international equity partner being advised by Fieldstone; and Pentaquark Energy, a decentralised energy and distributed energy solutions specialist, about to come on board as strategic partner.

"The project will be funded on a limited recourse finance basis with financial close aimed at meeting commercial operations by January 2018," says Zahed Sibda, managing director of Fieldstone Africa.

Implats has also negotiated the natural gas supply to the facility with Springs Light Gas, a leading supplier of piped natural gas in southern Africa. Says Nkosinathi Solomon, CEO of Springs Light Gas: "We are excited to partner with Implats on this strategic initiative of national economic significance."

Phase one of the project involves the installation of 20 Doosan fuel cells generating around 400 kW each to provide 8.0 MW of power, mooted to be operational by mid-2017. But the long-term goal is to install three or four of these power banks to supply the 22 and 30 MW of power needed by the refinery.

"Doosan is excited to be a part of the clean energy evolution in South Africa with its PureCell Model 400 combined heat and power solution," says Eric Strayer, vice president of international sales for Doosan. He says that South Africa is embracing new ways to solve their energy challenges. "By deploying fuel cells as a decentralised, clean energy generation solution, the country could become the prototype for the future of energy production," he suggests.



The scalable Doosan PureCell® 400 can generate up to 440 kW of clean electricity when new, reducing to 400 kW after 10 years of use.

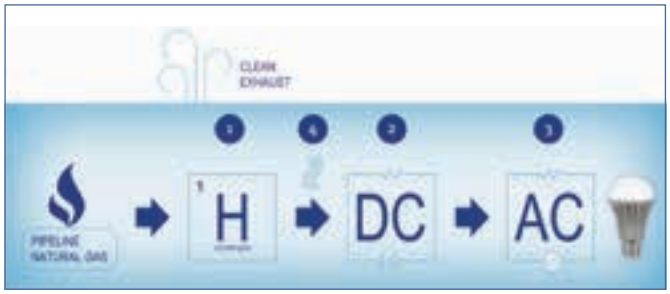
Commenting on the importance of this project, Fahmida Smith, fuel cell coordinator at Impala Platinum Refinery adds: "The development of Implats' 8.0 MW fuel cell is an exciting move towards a more carbon-neutral fuel source at its refinery. The technology generates combined heat and power and will result in a significant reduction in our costs over its 20 year life."

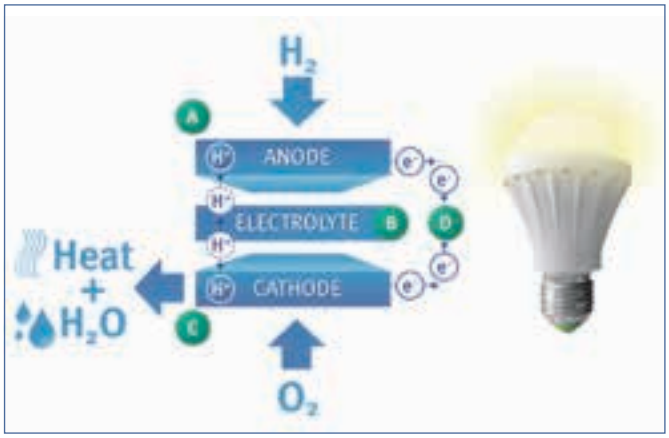
This initiative is part of Implats' strategic objective to fast-track local manufacturing of fuel cells and its componentry within a proposed 16-hectare tributary of the Special Economic Zone (SEZ) in the Springs region. The project, in partnership with the Department of Trade and Industry, the Gauteng Industrial Development Zone and supported by the Ekurhuleni Metropolitan Municipality, is a longer-term strategic investment to promote platinum beneficiation within South Africa.

It is also a collaborative effort by various departments of the South African Government with ties to strategic local and international partnerships through the Impala Roadmap, which aims to develop fuel cell technology to drive knowledge-based skills development and job creation and to increase foreign direct investment in South Africa. This strategy envisages partnerships with international manufacturers and, in time, the backward integration of local South African sub-components.

"The Impala Roadmap represents critical steps in support of the fuel cell industry, specifically for the development of manufacturing capacity in South Africa, where the predominant supply of the critical platinum componentry is mined. The opportunities identified through local manufacturing are entrenched in the roadmap through extensive collaboration between industry, government and academia in South Africa," adds Smith.

In the long term, Implats will maintain a strong emphasis on the deployment of fuel cell technology and energy-efficiency projects.





Above: *The PureCell is designed to be powered by natural gas rather than hydrogen. The gas (CH_4) is 'cracked' to provide the hydrogen needed to fuel the cell.* ***Right:*** *Doosan fuel cells use phosphoric acid (H_3PO_4) as the electrolyte, saturated in a silicon carbide matrix (SiC). The electrodes are made of carbon paper coated with a finely dispersed platinum catalyst.*

The company has invested over R100-million in energy conservation programmes and will continue to work with Eskom while participating in various demand-side management programmes.

"Fulfilling a prominent role in developing the nascent fuel cell industry in South Africa is part of Implats' strategic objective to demonstrate responsible stewardship of our mineral and energy resources," says Smith.

A 2.2 MW fuel cell came online at a regional high school is in Connecticut in January 2017. The fuel cell is linked to a microgrid and will power the school during a prolonged power outage. Waste heat from the fuel cell will also be used to heat the high school.

Doosan's PureCell 400

The scalable Doosan PureCell® 400 can generate up to 440 kW of clean electricity when new, reducing to 400 kW after ten years of use. In addition, the system produces nearly 500 kW of useable heat. The PureCell is designed to be powered by natural gas rather than hydrogen, which means it cannot make the claim that only water vapour is emitted. But it also means that it is ideal for fuelling from a piped gas supply.

Doosan uses phosphoric acid fuel cells with highly concentrated pure liquid phosphoric acid (H_3PO_4) as the electrolyte, which is saturated in a silicon carbide matrix (SiC). The electrodes are made of carbon paper coated with a finely dispersed platinum catalyst – hence Implats' long-term interest.

The operating temperature range is about 150 to 210 °C, creating the opportunity to utilise the 'waste' heat for combined heat and power applications. When the heat can be gainfully used, Doosan claims an operating efficiency of up to 90%.

Reliability wise, a remarkable 98% uptime across the fuel cell stack life of ten years is being reported. So not only do these fuel cells run cleaner and more efficiently, as a power generation alternative they are more reliable than nearly all other alternatives.

The costs? Doosan claims a generation cost of 14 to 15 US-cents per kWh, which is within the range being reported in the December 2016 version of Lazard's Levelised Cost of Energy (LCOE) Analysis – US$119-$182 per MWh or 11.9 to 25 UC-cents per kWh. The Lazard LCOE range for nuclear power in the USA is not that much cheaper: $97 to $136 per MWh.

Hybrid renewable and fuel cell solutions?

Arguments against renewable energy generation from solar PV and wind generation are no longer restricted to costs. For PV systems, cost parity is already being claimed for some projects. But their intermittent nature means that either storage solutions are necessary or renewable systems need to be coupled with traditional generation for continuity of supply – at night or when the wind drops.

For distributed solutions such as microgrids, therefore, gas or diesel generators are often coupled with PV, wind or hydro plants to ensure continuity of supply regardless of the available sunshine, wind or water flow.

Fuel cells, which are already being widely used as backup power for cell phone towers and data centres, offer an ideal alternative to gensets for these distributed microgrid applications. They can be brought online quickly and regulated to supply the generation shortfall when demand exceeds that available from renewable energy plants.

A PV system coupled with a fuel cell could well offer an ideal hybrid clean generation solution, one that is not far away for grid-cost parity and without the disadvantages of intermittency.

The rise of FCEVs

At a factory in Michigan in the US, General Motors and Honda plan to invest US$85-million to build hydrogen fuel cell stacks for the next-generation fuel cell electric vehicles (FCEVs). The joint venture, Fuel Cell System Manufacturing, will begin producing the fuel cell systems in around 2020 out of GM's Brownstown Township plant south of Detroit, which currently produces battery packs for hybrid and electric vehicles.

GM and Honda say that cooperating on developing fuel cells will slash costs and boost efficiencies. The goal is lighter, smaller, more powerful and less costly stacks that use hydrogen as the fuel to produce electricity to power cars.

Fuel cells "are not a science project anymore," says GM executive vice president Mark Reuss, which is clear from the success of the Honda Clarity and the Toyota Mirai.

In the fuel cell electric vehicle (FCEV) the drive train is 100% electric, with the fuel cell and its hydrogen fuel tank replacing the Li-ion battery pack used in electric vehicles.

Clearly, the hydrogen-refuelling infrastructure is a huge hurdle, but even this is not that far away. ❑

Hybrid sales pass the ten million

Toyota Motor Corporation has announced cumulative global hybrid vehicle (HV) sales of 10.05-million units as from January 31, 2017, surpassing the 10-million unit mark.

More than a numerical milestone, Toyota Hybrid sales demonstrate the staying power of a technology that is now emerging as a mainstream solution to reduce greenhouse gas emissions and other pollutants.

Helping to mitigate the environmental effects of automobiles has long been a priority for Toyota. Based on the stance that environmentally friendly vehicles can only truly have a significant positive impact if they are widely used, Toyota has encouraged the mass-market adoption of hybrid vehicles across the globe.

Toyota launched the Coaster Hybrid EV in August 1997 and the Prius – the world's first mass-produced hybrid passenger vehicle – in December of the same year. Since then, Toyota hybrid vehicles have received tremendous support from consumers around the world. This latest milestone of 10-million units was achieved just nine months after total sales reached nine million units at the end of April 2016.

The Toyota Hybrid System (THS), which was incorporated in the first generation Prius, evolved into THS II in 2003, and was thereafter rolled out in a wide range of Toyota vehicles.

The fourth-generation Prius, which became the first vehicle to be built using the Toyota New Global Architecture (TNGA), was developed not only with environmental performance in mind, but also with driving performance for customers wanting to purchase a car that was fun to drive.

Toyota's Prius Hybrid Vehicle (HV) has reached the 10-million unit milestone, demonstrating the staying power of hybrid technology.

Now that customers around the world are opting to purchase hybrid vehicles and other fuel-efficient vehicles, the entire automobile industry has been able to contribute to the solution of global environmental problems, creating ever-better cars for its customers.

"When we launched Prius, no one even knew what a hybrid was. Those who drove it were called geeks or other names. Today, thanks to those early adopters who gave Prius a chance, hybrids have grown in popularity and ridden a wave of success out of the unknown and into the mainstream," says Takeshi Uchiyamada, chairman of the board of directors at Toyota and the considered father of the Prius.

"We are grateful to each and every one of our customers who has helped us achieve this important milestone. We are committed to continue working hand-in-hand with them to tackle global environmental issues," Uchiyamada adds.

As of January 31, Toyota estimates that the use of Toyota's HVs in lieu of conventional gasoline-powered vehicles of similar size and driving performance has resulted in approximately 77-million fewer tons of CO_2 emissions and saved approximately 29-million kilolitres of petrol.

Looking to the future, Toyota announced the Toyota Environmental Challenge 2050 in October 2015, setting challenges that it will undertake to help reduce the negative impacts of automobiles on the global environment to as close to zero as possible, and to contribute to the creation of a sustainable society.

The Hybrid class encompasses all of the component technologies necessary for the development of environmentally friendly vehicles, from battery electric to fuel cell hydrogen vehicles, which facilitate the use of different fuel combinations. Toyota is committed to further expanding its line up of new and differently configured environmentally friendly vehicles.

In the footsteps of the iconic Prius that started it all, Toyota now sells 34 different hybrid models in more than 90 countries and regions across the globe –including South Africa. Local hybrid models include the Yaris, Auris, Prius and, at the top of the range, the Lexus, which now has numerous different models: the Lexus CT 200h, ES 300h, NX 300h and the RX 400h SE. ❑

Pump Efficiency & Reliability Workshop

Harry Rosen: June 5, 2017, Durban

Eskom and the National Energy Efficiency Agency endorse Harry Rosen's pump efficiency course because it highlights how pumps can be managed to save electricity. The course will help engineers and technicians better understand how to optimise both existing and new pumping systems so as to reduce life cycle costs, mostly by drastically reducing energy usage and pump maintenance costs.

The course content includes: centrifugal pump operation and the benefits of improved efficiency; pump and system interaction and the total cost of ownership; scope and opportunities for pump system optimisation; improving the performance of existing pumping systems; and designing more efficient pumping systems.

For more information contact: Phindi Mbedzi at 2KG Training. phindi@2kg.co.za

Industry diary

Nuclear Africa 2017
29-31 March 2017
Nt'Shonalanga Valley Resort
Centurion, South Africa
Carol van Niekerk
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carolyn@nuclearafrica.co.za

European Coatings Show
4-6 April 2017
Kevin Noels
+31 164 317 011
knoels@emg-pr.com

9th Annual Wind O&M Dallas 2017
New Energy Update
10-12 April 2017
Dallas, USA
Victoria Auckland
vauckland@fc-bi.com

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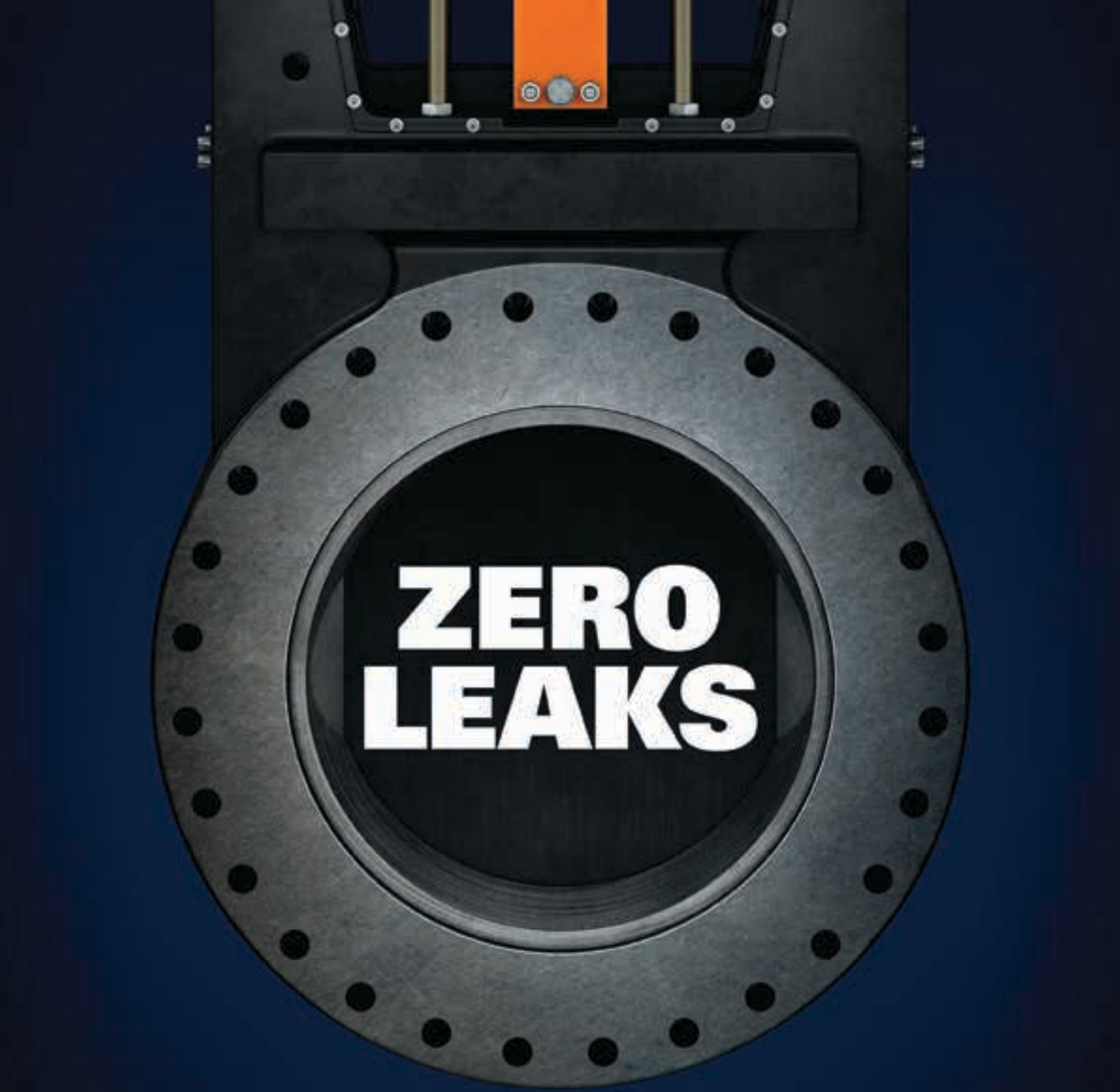

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