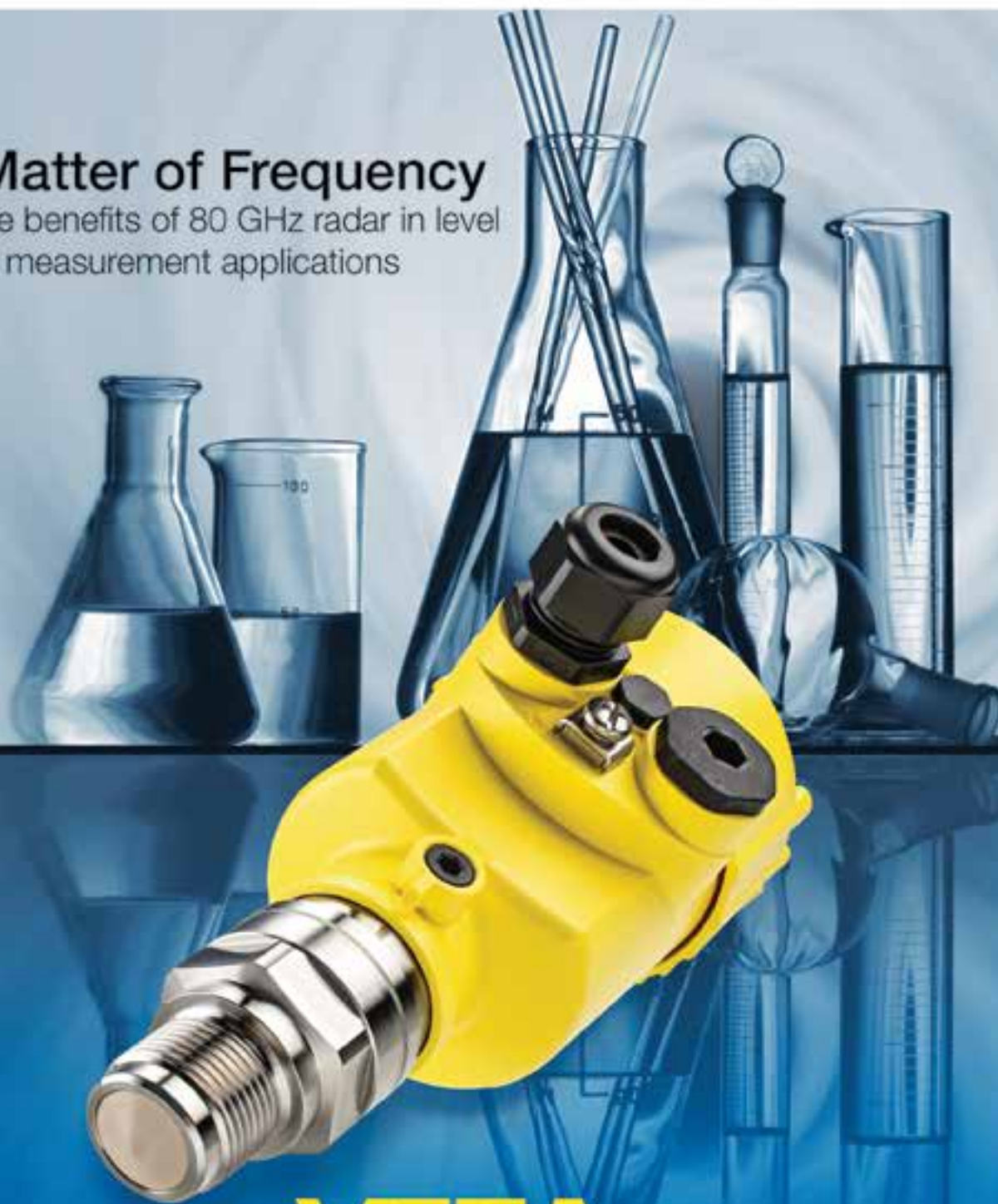


A Matter of Frequency

The benefits of 80 GHz radar in level measurement applications



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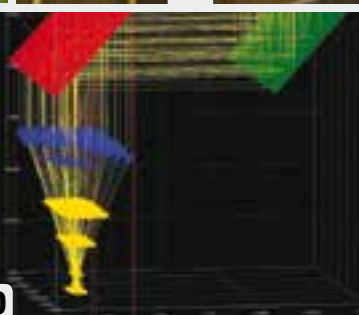
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A matter of **frequency**

The benefits of 80 GHz radar in level measurement applications

Two of the process control industry's most recognisable names recently announced plans to launch 80 GHz radar instruments for liquid level measurement. This development signals a brave new world in level measurement, one where, radar can go where it has never gone before.

This heralds an exciting era in automation. With high-frequency devices on the rise, now is a good time to examine why radar technology is coming into its own and the benefits of using these new sensors in automated processes.

Advancements create availability

The availability of 80 GHz radar sensors is a function of cost and innovation. Microwave development has advanced to the point that it is comparatively affordable, and the decreased expense has led to increased use across multiple industries. Just as computer hardware prices dipped low enough to put a PC in every home, it is now possible to put 80 GHz radar in every plant. This was thought impossible a mere 20 years ago.

Yet cost was not the only thing stopping plant operators from using high-frequency radar before now. On their own, high frequency sensors do not stand up to harsh process conditions as well as their lower-frequency cousins, which are adept at penetrating foam and performing through condensation and build-up. However, modern radar instruments are engineered to overcome these obstacles with large dynamic range and software algorithms that filter out interference. These innovations have made the affordable technology relevant to real applications.

Now that 80 GHz radar is available and practical for liquid



level measurement, users should get accustomed to sensors with better focus, versatile size, and enhanced resolution.

Focus

This is the alpha benefit of 80 GHz radar; the one that makes the others possible. In every process, signal focus is crucial to accurate level measurement, and these new instruments emit the most focused signals on the market.

Plant operators have struggled with unfocused radar for decades. The wide beam angle of 26 GHz sensors (and 6 GHz sensors before them) made it difficult for radar signals to miss agitators, heating coils and other vessel internals. The reflections from these installations distorted the echo curve and users were forced to make adjustments to monitor the true liquid level. The new high-transmission models have narrower beams that miss vessel installations. It is as if they are not even there. That is welcome news in chemical and food production, where obtrusive internals are the norm and space is at a premium.

Superior focus makes for accurate measurement without adjustment, but it also opens the door for two other major benefits.

Size

Because their focus is amped up, 80 GHz sensors have



A radar beam with 80 GHz only reflects from the product surface. A 26 GHz beam also reflects signals from agitators and internal fixtures.

small antennas. The new VEGAPULS 64, for example, has the world's smallest antenna and does not require a large horn to focus its beam at the measured material. The instrument's small size makes a huge impact, particularly as it applies to retrofitting. Plants can now integrate the most advanced radar devices into their process without shelling out thousands for modifications to their vessels. Smaller instruments, however, are not just good for old vessels; they can also help manufacturers stay nimble and market-responsive.

There is a trend in the pharmaceutical and chemical industries toward batch production. Batching allows operators to produce seasonal and low-volume products with less financial investment. Small batches are produced in small vessels, where conventional wisdom says using radar is impossible due to small process connections. Thanks to the compact design of 80 GHz radar sensors, that is no longer true, and operators no longer have to sacrifice accurate measurement in the name of space.

Resolution

Imagine looking at the picture on a standard definition television next to that of an HD TV. The high definition picture would be clearer, sharper, and more detailed due to enhanced resolution. Users will see a similar difference

switching from low-frequency to high-frequency radar sensors.

When the level of liquid in a vessel gets low enough, 26 GHz radar reads the echo from the material and the echo from the tank bottom as one echo. This tells the user the vessel is empty when it is not in fact empty and presents a natural handicap to process efficiency. 80 GHz devices measure liquid down to the last millimetre, giving users accurate data they can use to optimise their processes. Greater resolution is particularly important for shipbuilders, who count on precise level in large ballast tanks.

Conclusion

High-frequency radar sensors are the "next big thing" in level measurement. They are the proverbial "giant leap", a marker in time after which the process industry will never be the same. Their excellent focusing makes them perfect for vessels crowded with internals, their small size makes them ideal for retrofitting and batch production, and their unrivalled resolution allows users to get every last drop of space from their tanks. The future of level measurement is here.

To learn more, visit: vega.com/radar

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Five chemical engineering research stories

Researchers from Russia analysed the possibility of using low-cost plant-based sorbents modified in various ways to clean up water surface oil spills as opposed to man-made sorbents such as perlite, expanded clay, or silica gel. This article was published as part of the *Process Safety and Environmental Protection* special issue on Air Pollution Control and Waste Management. The researchers identified sorption as the most effective and environmentally acceptable but the most expensive method for oil spill clean-up. However, using plant-based sorbents can improve cost-effectiveness and the plant waste can later be recycled for asphalt production and fuel.

Carbon capture and storage (CCS) has gained great interest in recent years as a potential technology to mitigate industrial carbon dioxide (CO₂) emissions. Chemical engineers from Malaysia and Qatar have been working to identify ionic liquids (ILs) as potential CO₂ capturing solvents. Because of their negligible vapour pressure, high thermal stability, and wide range of thermophysical properties ILs have huge potential. In an article published in *Molecular Systems Design & Engineering*, the team presents a systematic approach to design an optimal IL to use in CCS.

Analysts are predicting that by 2020, there will be a widespread use of LED lightbulbs across the world leading to a steep decline in domestic electricity consumption. This paper, from researchers at the University of Manchester's Sustainable Consumption Institute, published in *Sustainable Production and Consumption*, discusses the need for us to understand how energy consumers feel about light and domestic spaces in order to avoid past frustrations caused by the minimal reductions in energy consumption when transitioning from

standard to energy-efficient lightbulbs.

Chemical engineers in Japan have developed a vesicular aggregate filled with lipid molecules that exhibited crawling motion over a glass surface as a result of chemical reactions! Published in the journal *Molecular Systems Design & Engineering*, the crawling motion was induced by a chemical reaction between didodecyldimethylammonium bromide (DDAB) and sodium oleate with calcium ions, and it caused discharge of the inner lipids.

The authors claim that this is probably the first example of an amphiphilic molecular assembly that exhibits crawling motion as a result of chemical reactions without size reduction. This could be regarded as the cell-like behavior of an abiotic molecular assembly with a metabolic-like process.

Fibres from the Australian native spinifex grass are being used to improve latex that could be used to make condoms as thin as a human hair without any loss in strength. Professor Darren Martin from The University of Queensland's Australian Institute for Bioengineering and Nanotechnology (AIBN) said the spinifex nanocellulose significantly improved the physical properties of latex.

Working in partnership with Aboriginal traditional owners of the Camooweal region in north-west Queensland, the Indjalandji-Dhidhanu People, the team has developed a method of extracting nanocellulose – which can be used as an additive in latex production – from the grass.

AIBN's Dr Nasim Amiralian, said the nanocellulose could be converted from spinifex using an efficient chemistry method.

This is a shorter version of a blog posted on 24 June 2016 by IChemE Blog Elf.



#Brexit and the impact on research and technology for the world

by Gavin Chait

The difference between last year and next year can be life-changing.

Mid-way through 2015, I applied for grant funding for my new start-up, Pikhaya.com. The Open Data Incubator has €7,8 mil from the EU's Horizon 2020 fund to provide €100 000s to viable startups. My UK-registered company applied and was accepted into the first tranche of grantees to kickstart my new business. Without that funding, it would probably not have gotten off the ground.

A year from now, we will no longer qualify for that funding. The UK will be out of the EU.

On 24 June, across the UK, highly-skilled professionals woke up to discover that the majority of people had voted in a referendum for the UK to leave the EU. All the leading universities, research institutes, business organisations, unions, political parties and civil society groups had campaigned to remain in the EU. It had little effect.

'Project Fear', as the Remain campaign came to be called, was seen as overhyped and unbelievable. The reality is that it was too restrained.

According to Unesco's 'Science Report', the EU has 22,2 % of the world's scientific researchers, compared to

19,1 % in China and 16,7 % in the US. Better yet, the free movement of researchers and their families has permitted polyglot teams to emerge, and the collaboration between governments to create a single source for funding.

The sheer scale of research investment possible when a population of 500 million collaborates has resulted in the multinational super-collider at CERN, as well as production of the super-expensive equipment necessary to research nano-materials or rare particles.

Researchers at the University of Manchester first identified graphene in 2004, when physicists Andre Geim and Kostya Novoselov first described their successful isolation of the atom-thin carbon material. Both are immigrants. Geim is a Soviet-born Dutch-British physicist. Novoselov is, similarly, Soviet-born.

Their research led directly to the UK government investing over €50 million into the development of the National Graphene Institute (NGI), supported with an additional €35 million from the European Regional Development Fund.

Overall, 62 % of all funding put into nanotech research has come from the EU, along with 67 % into evolutionary biology. Over the last decade, the UK has received some €12 billion in research grants from the EU. The UK is the second largest beneficiary of European Commission and

European Research Council funding, at 16 %, and the largest from Horizon 2020.

All of this support has permitted the UK to spend less on research as a proportion of GDP (1,6%) than any other developed country, ranking twentieth, according to the World Bank. More importantly, almost all growth in the UK's scientific output has come from international collaborations with over 50 % of papers produced having international co-authorship. Such international papers are also much more likely to be cited by others.

All of this EU collaboration ensures the avoidance of duplicated research, a widespread understanding and support for research objectives, a common framework for categorising and funding research, as well as removal of the sort of vast bureaucracy that would ordinarily gum up such international consortia.

As Victoria Bateman, an economist at Cambridge University, put it in Bloomberg: "With just under 1 % of the world's population, the UK is home to 3,3 % of the world's scientific researchers and produces almost 7 % of the world's scientific output and 15 % of the most highly cited papers."

The UK leave vote has put all that in jeopardy. At its core, the coalition behind Leave wanted the following: end of free movement, and end of money spent paying to EU funds.

The Leavers believe that this money (about €120/person) can then be reprioritised on things important to the UK and so make up for any loss of funding. The UK also believes it can pick the programmes it still wishes to belong to, like Horizon 2020 which is the main fund for all research and development.

There are some countries, like Switzerland, that are not in the EU but do participate. However, participation is conditional on free movement. Since Switzerland had a referendum in 2014 that blocked free movement from the EU (specifically Croatia), they are due to be kicked out of Horizon 2020.

Economists have predicted that the UK's economy will shrink by anywhere from 1 % to 9,5 %, and that this annual loss will be significantly greater than the fees paid to the EU. There won't be extra money to pay for things that EU membership currently pays for. The stock market losses in the first few days following Brexit already exceeded the grand total paid by the UK into the EU in 40 years of membership.

Worse, though. Consider what it is like to be a professional researcher. You are likely to have a spouse with his or her own career. Most expats have to make the difficult

decision that one spouse gives up their professional development in favour of the other. Being an expat is challenging.

However, if you live in Bloemfontein and you're offered a fancy new job in Johannesburg, your spouse can start looking for alternative jobs there as well. The same goes if you move from Munich to Cambridge as an EU citizen. No forms, no visas, no paperwork. You just move.

Given that the UK government is making it clear (as mud) that EU citizens won't be permitted to stay without a visa after exit, many are starting to react now.

So, yes, while the actual negotiations could take years, researchers and funders are already starting to act as if the UK is no longer part of the EU. Grantees have been told to act accordingly.

Think about it like this, if you have a six-person team based in Cambridge that has just won a five-year grant from Horizon 2020 to study nano-materials in the treatment of rare forms of cancer and you are about to set up your lab, where will you do so?

If four of your team are from Europe, and you're likely to need to hire more specialists, you might decide to see if Munich has any universities that want your team instead. If two people lose their jobs, better than four doing so with the loss of your funding.

All across the UK, professionals and aspirational youngsters are looking to the future and trying to figure out what they should do. Others spot an opportunity. The German government has suggested offering talented Brits dual citizenship. Spain has demanded that the European Medicines Authority, currently based in London and the most important regulator in healthcare, move to Madrid.

The UK, which has been central to deciding on research topics that would be funded, and in designing and implementing the rules that the entire EU plays by, is being sidelined. The UK is still in the EU, but not part of it. History is already moving on.

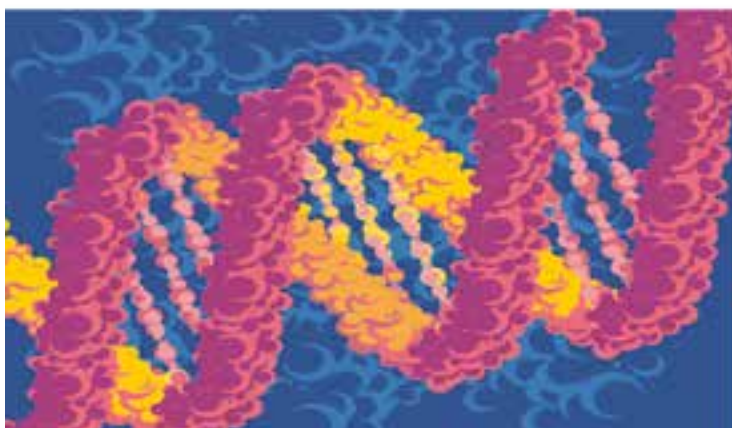
This is certainly a tragedy for the UK specifically. Even if the country does not suffer the indignity of dismemberment (as Scotland and Northern Ireland leave the union), it will be poorer, more isolated, and less core to the conversation and development of the future. More like Iceland than Switzerland.

If this only affected the UK, then we could all watch and eat popcorn and enjoy the defenestration. However, there are research teams that have been together for decades that will now lose funding or be broken up. There are critical breakthroughs that, only years away, are now decades away.

Brexit leaves the world poorer, more polarised, more bigoted and less capable of the sort of collaboration necessary to tackle big global challenges like climate change, migration, cancer, and obesity.

The UK has also been – as far as research is concerned – a liberal force on the continent. Research into embryonic stem cells, which hold such potential for so many fields, was being blocked by Germany, Italy and Austria. It was the UK that worked out a compromise that meant that research partners from countries which don't support such research don't have to handle embryonic stem cell tissue.

A country known for pragmatic compromise has just shown itself out. We're all poorer for it.



Nanotechnology 'tattoo' can map emotions and monitor muscle activity

A new temporary 'electronic' tattoo developed by Tel Aviv University (TAU) that can measure the activity of muscle and nerve cells researchers, is poised to revolutionise medicine, rehabilitation, and even business and marketing research, according to a recent report in 'Nanowerk News', dated 11 July 2016.

The tattoo consists of a carbon electrode, an adhesive surface that attaches to the skin, and a nanotechnology-based conductive polymer coating that enhances the electrode's performance. It records a strong, steady signal for hours on end without irritating the skin.

The electrode, developed by Prof Yael Hanein, head of TAU's Centre for Nanoscience and Nanotechnology, may improve the therapeutic restoration of damaged nerves and tissue -- and may even lead to new insights into our emotional life.

Prof Hanein's research was published last month in 'Scientific Reports' ("Temporary-tattoo for long-term high fidelity biopotential recordings") and presented at an international nanomedicine programme held at TAU.

One major application of the new electrode is the mapping of emotion by monitoring facial expressions through electric signals received from facial muscles. "The ability to identify and map people's emotions has many potential uses," said Prof Hanein. "Advertisers, pollsters, media professionals, and others -- all want to test people's reactions to various products and situations. Today, with no accurate scientific tools available, they rely mostly on inevitably subjective questionnaires.

"Researchers worldwide are trying to develop methods for mapping emotions by analysing facial expressions, mostly via photos and smart software," Prof Hanein continued. "But our skin electrode provides a more direct and convenient solution."

The device was first developed as an alternative to electromyography, a test that assesses the health of muscles and nerve cells. It's an uncomfortable and unpleasant medical procedure that requires patients to lie sedentary in the lab for hours on end. "Our tattoo permits patients to carry on with their daily

routines, while the electrode monitors their muscle and nerve activity," said Prof Hanein. "The idea is: stick it on and forget about it."

According to Prof Hanein, the new skin electrode has other important therapeutic applications. The tattoo will be used to monitor the muscle activity of patients with neurodegenerative diseases in a study at Tel Aviv Medical Centre. Physiological data measured in specific muscles may be used in the future to indicate the alertness of drivers on the road; patients in rehabilitation following stroke or brain injury may utilize the 'tattoo' to improve muscle control; and amputees may employ it to move artificial limbs with remaining muscles."



Temporary-tattoo for long-term high fidelity biopotential recordings.

More information: Lilach Bareket et al, Temporary-tattoo for long-term high fidelity biopotential recordings, *Scientific Reports* (2016). DOI: 10.1038/srep25727 Source: American Friends of Tel Aviv University, reported in 'Nanowerk News' at <http://www.nanowerk.com/nanotechnology-news/newsid=43905.php>

Molecularly-limited fractal surface area of mineral powders

An interesting article appeared in the Open Access journal, 'Minerals', 2016, 6(2), 44; (doi:10.3390/min6020044). This article belongs to the Special Issue 'Mineral Surface Science and Nanogeoscience' (Academic Editors: Athanasios Godelitsas and Huifang Xu) and is entitled "Molecularly-Limited Fractal Surface Area of Mineral Powders".

Authors: Petr Jandacka, Jaromir Pistora, Jan Valicek and Vilem Madr, from various institutions in the Czech Republic. Petr Jandacka is the author to whom correspondence should be addressed, at IT4Innovations Centre and Nanotechnology Centre, VSB: Technical University of Ostrava, Czech Republic.

The abstract reads as follows:

The topic of the specific surface area (SSA) of powders is not sufficiently

described in the literature in spite of its nontrivial contribution to adsorption and dissolution processes. Fractal geometry provides a way to determine this parameter via relation $SSA \sim x(D-3)s(2-D)$, where x (m) is the particle size and s (m) is a scale. Such a relation respects nano-, micro-, or macro-topography on the surface. Within this theory, the fractal dimension $2 \leq D < 3$ and scale parameter s plays a significant role. The parameter D may be determined from BET or dissolution measurements on several samples, changing the powder particle sizes or sizes of adsorbate molecules. If the fractality of the surface is high, the SSA does not depend on the particle size distribution and vice versa. In this paper, the SSA parameter is analyzed from the point of view of adsorption and dissolution processes.

In the case of adsorption, a new equation for the SSA, depending on the term $(2-D)(s_2-s_{BET})/s_{BET}$, is derived, where s_{BET} and s_2 are effective cross-sectional diameters for BET and new adsorbates. Determination of the SSA for the dissolution process appears to be very complicated, since the fractality of the surface may change in the process. Nevertheless, the presented equations have good application potential.

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Water, sanitation and hygiene

by Robert Bain, Richard Johnston, Cecilia Scharp, Rifat Hossain, Bruce Gordon and Sanjay Wijesekera, all of either UNICEF or WHO

This article reflects on the role of water, sanitation and hygiene (WASH) in achieving sustainable development, and outlines key challenges that need to be addressed in order to achieve and sustain universal coverage.

WASH is fundamentally important to lives and livelihoods, and underpins poverty alleviation and sustainable development. At a basic level, everyone needs access to safe water in adequate quantities for drinking, cooking and personal hygiene, and sanitation facilities that do not compromise health or dignity. Lack of WASH takes a huge toll on health and well-being and comes at a large financial cost, including a sizeable loss of economic activity in many countries, not just least developed countries. While the impacts are most pronounced in lower income countries, challenges remain in wealthier nations where concerns regarding water safety and environmental sustainability persist alongside inequalities. Many of the broader implications of inadequate WASH – for education, cognitive development and nutrition – are not fully documented, and inadequate WASH is one of many deprivations suffered by the world's poorest and most marginalised populations.

Access to water and sanitation is recognized as a human right and has long been a central aim of international development policies and targets [1]. The MDG's (Millennium Development Goals) sought to "halve the proportion of the population without access to safe drinking water and basic sanitation" between 1990 and 2015 [2]. The WHO and UNICEF Joint Monitoring Programme for Water supply and sanitation (JMP) reports impressive gains made over the last two decades with 2,3 billion people gaining access to an improved drinking water source and 1,9 billion to an improved sanitation facility [3]. Of those gaining access to drinking water, 1,6 billion now use a higher level of service: a piped water supply on premises. However, much still needs to be done – 748 million do not use an improved source of drinking water and 2,5 billion do not use an improved sanitation facility. Moreover, not all of those using improved facilities have fulfilled their rights; for example, an estimated 1,8 billion people drink water contaminated with *Escherichia coli*, an indicator of faecal contamination [4].

Hand washing with soap is one of the important elements of hygiene in WASH, although it did not form part of MDG monitoring. Globally, the prevalence of hand washing with soap is very low with some estimates suggesting four out of five people do not wash their hands after contact with excreta [5]. Moreover, many challenges remain in addressing concerns about the adequacy of WASH services and ensuring their sustainability.

Return on WASH investments

Investments in water and sanitation services result in substantial economic gains. In developing regions, the return on investment has been estimated at USD\$5 to USD\$28 per dollar invested [6]. Overall, USD\$53 billion per year over a five-year period would be needed to achieve universal coverage [7] – a small sum given this represented less than 0,1% of global world product in 2010 and since the return on investment is many times higher.

Despite the potential for sizeable returns on investment, sustainable financing has not yet been attained in many settings, raising questions about who should pay and what the barriers to investment are. In many cases, capital investments are made without adequate financial planning or investment in maintenance, operations and monitoring [8] which leads to poor levels of service (eg, quality, reliability, acceptability), lower usage and, in some cases, permanent failure. Such unsustainable financing not only reduces the benefits but also wastes available capital, resulting in lower coverage per dollar spent.

From the user's perspective, the affordability of WASH services is of utmost importance and may influence access, especially for the poor. The financing of water and sanitation, including the proportion contributed by households, varies greatly [9] as does willingness to pay for water and sanitation services. Data on household contributions are few and generally available at the national level,





preventing assessments of affordability for the poorest. In most countries, regressive cost structures predominate whereby low volume consumers pay a premium on a per volume basis. There are some notable exceptions, such as South Africa (see focus below), where a basic level of service is free to the end user.

In order to reap the full benefits of these services, greater emphasis is needed on ensuring that services last. In many settings, services are not living up to their potential, with intermittency a daily problem for piped supplies even in major cities, and functionality of community sources and hygienic sanitation facilities not always assured. The problem of non-functioning supplies and unused sanitation facilities is symptomatic of unsustainable or misdirected financing and a mismatch between supply and demand. This points to the need for greater accountability, enhanced monitoring as well as adequate financing for continued operations and maintenance. This is not restricted to lower income countries. The investment 'deficit' for ageing infrastructure in the United States has been estimated at USD\$84 billion by 2020 [10]. Water services should also be located close to or ideally within the home in order to ensure that time can be used more productively since opportunity costs are an important contributor to the overall return on investment [11] and to support good hygiene.

Environmental implications

The quantities of water required for domestic uses, and especially ingestion, are generally very small compared with those for agriculture and industry: 20 litres per person per day for drinking and personal hygiene is considered to be 'basic' access [13]. Domestic water accounts for at most 11 % of freshwater withdrawals [14]. Yet the availability of water and sanitation services is intimately linked to the wider policies and practices in water management.

Unregulated abstraction can influence local availability of water and its quality with negative repercussions for water services. Changing climate is also expected to influence water resource availability, putting more pressure on already stretched resources and increasing the risk of contamination due, in part, to more frequent and intense flooding [15].

Pollution of the environment in other spheres can also influence the ability to provide adequate quantities of high-quality drinking water or the costs and energy required to do so. Ensuring water safety requires a focus on source protection, rational use of fertiliser and pesticides, and reducing industrial pollution as integral elements of comprehensive water safety planning.

As societies develop, their water usage patterns change. Global trends in the use of different water sources demonstrate a shift towards piped water on premises, especially in urban areas. Use of piped water can be highly beneficial for societal well-being; however, it also generates a tendency to raise the quantity of water used per capita, increasing stress on local water resources and wastewater treatment facilities. In addition, household surveys show a marked increase in the use of packaged waters – bottles and sachets – in several countries, although, globally, this is a small proportion of people, with an estimated 6 % of people primarily relying on bottled water in 2010 [16]. There are concerns about the environmental sustainability of packaging water (especially the plastic waste) and affordability of this trend. In many lower-income countries, bottled water is a privilege of the wealthy who may resort to it due to lack of trust in the safety of municipal supplies.

Lack of sanitation and poor management of excreta has a detrimental impact on the environment. In many countries, the demand for sewer-connected sanitation coverage has meant increases in connections without due attention to treatment and disposal of wastewater. Although data are few, estimates suggest that even in upper-middle income

A focus on providing for the poorest leads to more equitable WASH outcomes in South Africa

“With the ending of apartheid, the Government of South Africa prioritised the provision of basic services including, water supply, sanitation and energy services.

“Ambitious targets were set within a policy framework that included ‘free basic water’ and ‘free basic sanitation’ for households with resources below the social grant amount (approximately US\$1 per day). In 2012, 3,47million and 1,84 million people benefited from free services for water and sanitation respectively.

“Resources were provided to decentralised organisations charged with providing basic WASH services. Strong monitoring frameworks were put in place to track progress against the targets. There remains, however, a major challenge in attracting and retaining professional staff to manage, operate and maintain WASH infrastructure.” [12]

countries wastewater from 75% of households with sewer connections may not receive adequate treatment [17]. The impact of releasing untreated human excreta to the environment is substantial, with negative impacts on rivers, lakes and coastal waters. Furthermore, the WHO and UNICEF JMP finds that one billion people do not use a sanitation facility and instead defecate in the open [18]. In addition to the clear risk to the health of communities, where open defecation takes place, the consequences for water and the environment are severe. The ideal solution from a sustainability perspective is to find productive uses for wastewater, especially in agriculture, thus relieving stress on water resources and treatment facilities as well as avoiding loss of nutrients. Where wastewater is to be treated, minimising the amount of wastewater generated improves the potential for adequate and efficient treatment. In countries where robust regulations and wastewater treatment exist, reducing energy use is a key challenge requiring innovative approaches.

Reducing disparities and enhancing services

Sustainable development and human rights perspectives both call for reductions in inequalities and tackling disparities in access to services. The human right to water and sanitation sets normative and cross-cutting criteria against which the adequacy of WASH services is to be judged. For WASH services to meet individual’s needs, they must be aesthetically and culturally acceptable so that people are willing to and continue to use them, reliable, functional and physically accessible for all, including the elderly and disabled. Services must be appropriate for a given population and setting, and therefore must be selected and managed in such a way as to enable participation from a wide range of stakeholders, including the customers.

Pronounced disparities in access to WASH services, for example between regions, rural and urban areas, and socio-economic groups, are well-documented [19]. In order to achieve universal access, there is a need for accelerated progress in disadvantaged groups and to ensure non-discrimination in WASH service provision.

Whereas some countries have made remarkable

progress in reducing inequalities, in others these gains have largely bypassed the poor and marginalised. Ethiopia provides an example of a country that has made great progress [20].

Coverage alone does not fully reflect inequalities; disparities are evident in the levels of service related to the safety, accessibility and reliability of water services. Even in countries where the majority of the population uses piped water on premises, certain minority groups may be neglected. For example, an analysis of data from Bosnia and Herzegovina found only 32 % of the poorest Roma use an improved source of drinking water compared with 94 % of the general population. In order to ensure sustainability, the type of service needs to be appropriate to the context and carefully chosen based on the available infrastructure, human and financial resources. In remote rural areas community sources such as boreholes can be more affordable than a piped system and easier to maintain. In these settings, safe household storage is essential to avoid contamination and creating potential breeding grounds for disease vectors.

Household surveys and national censuses also indicate that there are disparities within households, including gender. Women and girls are often responsible for collecting water, especially in rural sub-Saharan Africa where many must spend at least half an hour to do so, and some make multiple trips taking up two to four hours a day [21]. At school, lack of sanitation is more likely to hinder a girl’s educational attainment than a boy’s. Women’s involvement in local management of water supplies improves the chances of successful outcomes, illustrating the importance of inclusive and participatory approaches in sustainable water resource management.

Towards sustainable WASH services

Many challenges remain in securing sustainable WASH services for present and future generations and ensuring that these services are within environmental limits. The types of challenges vary considerably between countries, with attaining basic access the priority in some and enhancing services and meeting environmental targets in others.

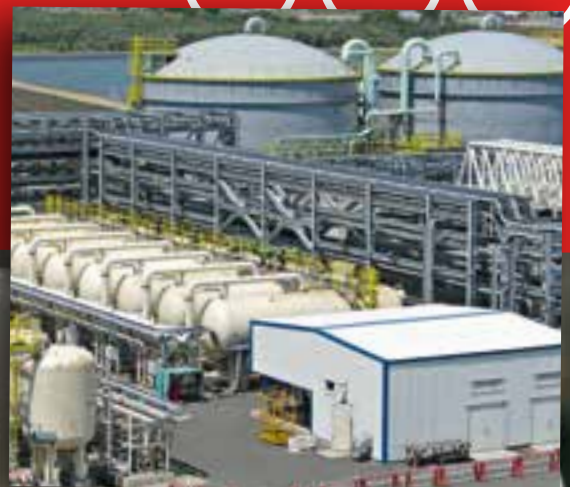
Globally, key targets for sustainable WASH identified by a wide stakeholder consultation include: universal access to basic water, sanitation and hygiene; elimination of open defecation; reduction of inequalities; progressive improvement of service levels; and safe management of water and excreta [22]. In order to achieve these goals, there is a need to focus on service delivery and not solely on capital costs, ensure that services are financially viable, enhance accountability and transparency in financing, strengthen independent regulatory agencies, and build capacity to monitor progress and assess inequalities in service. Creation of new infrastructure, while essential, will not suffice. A renewed focus on changing social norms is paramount.

This article forms Chapter 5 of the WWAP (United Nations World Water Assessment Programme), entitled ‘Water for a sustainable world’ and published in 2015 by UNESCO. Figures have been excluded and generic images have been added in this presentation. References are available from the editor at chemtech@crowm.co.za

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Atlas Copco's Water for All project changes the lives of primary school children



Atlas Copco's Water for All project changes the lives of learners from Mhlazane Primary School in Rorke's Drift, KwaZulu-Natal.

Through the Water for All project, Atlas Copco, a leading provider of sustainable industrial productivity solutions, sets out to make clean, potable water a possibility for all and the latest beneficiaries of this remarkable initiative are learners from the Mhlazane Primary School in Rorke's Drift, KwaZulu-Natal.

The Water for All project finances the installation of infrastructure and facilities that promote accessibility to clean water for disadvantaged communities in the rural areas. The project was first introduced to the Rorke's Drift area in 2011 and commenced with the drilling of three boreholes by Atlas Copco, in association with local NGO, the David Rattray Foundation. "Mhlazane Primary school was one of the beneficiaries of the project which was completed in late 2012," explains Kgothatso Ntsie, Atlas Copco South Africa's Corporate Communications Manager, South and sub-Saharan Africa.

Prior to the introduction of the boreholes, the school of over 465 learners, collected water from the river or depended on rainwater harvested in 'Jojo' tanks. At the end of last year, a delegation of eight Atlas Copco board members visited Mhlazane Primary School to witness the project's efforts and growth in South Africa. The delegation included Atlas Copco's Senior Vice President of Corporate Communications and Corporate Governance as well as Peter Wallenberg Jr, whose father helped start the initiative back in 1984.

"This is an exceptional experience which has opened the eyes of the board members to a region that has not has any rainfall since April and to see the good effect this project is having on the school," remarked Wallenberg. Commenting on the good work being done by the David Rattray Foundation helping some 19 schools in the area, he highlighted the fact that such a small foundation can do so much.

Atlas Copco donated ten soccer balls to the learners and the cheerful atmosphere became even more festive when the learners entertained the delegation with singing and dancing. School Principal, Mrs. Ndlovu, was thrilled to have international guests at her school and expressed her gratitude stating that the project had changed their lives for the better.

"Given the protracted drought that is gripping large regions of southern Africa, the importance of this project cannot be overstated," notes Kgothatso. "Water gives life and the Water for All project is making a difference in the lives of many people and is also in line with Atlas Copco's commitment to sustainable productivity through standing by our responsibilities towards our customers, our environment and the people around us. The school visit was a huge success; the board members were most impressed with the efforts and left feeling proud of their association with Atlas Copco."

To learn more about Water for All and the Peter Wallenberg Water for All Fund, please visit <http://www.water4all.org/us/>

Water treatment: the critical role of temperature maintenance in caustic lines

Over the last 60 years Thermon has been at the forefront of developing trace heating solutions and has vast experience in many applications.

When it comes to water treatment, caustic soda is needed to raise the pH of water. Caustic has its challenges as it is hazardous in its dry form and, in its dissolved state, is susceptible to temperature fluctuations which cause significant changes in viscosity and, in addition, has a tendency to crystallise.

Increasing caustic concentration reduces infrastructure requirements. To illustrate, to use low concentrations of caustic, more water is required for dilution, bigger pumps and pipes are required for transfer, as well as bigger storage tanks to deliver the volumes.

With the introduction of a simple heating design on the tanks and trace heating on the pipelines, it is easily possible to store, deliver and process with high caustic concentrations, thus resulting in more efficient systems.

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Veolia completes sewage treatment plant in Mozambique

Veolia Water Technologies South Africa (Veolia) completed a civil-based sewage treatment plant (STP) for CLN Nacala Corridor Project, the port and railway link in Mozambique. The STP was a turnkey project consisting of civil, electrical and mechanical installation, designed with trickling filter technology to cater for a maximum of 500 people per day (500 PE).

The plant has the capacity to process 100 m³ of sewage per day, servicing the port's administration block. As a turnkey project, civil design and construction formed part of Veolia's scope of work, in addition to the supply and installation of all mechanical and electrical equipment.

Veolia employed trickling filter technology as the most appropriate technology to ensure that the STP discharge water was treated to the client's specification. "It is the ideal sewage treatment solution for this application," explains Hirsheda Jeram, Project Manager, Veolia Water Technologies South Africa. "It works well in high temperatures and in remote locations, and is used to treat domestic sewage high in organic matter like

BOD, COD and various other pollutants." The turnkey sewage treatment plant replaces multiple septic tanks previously used by the coal terminal port.

She adds that, in addition to high temperature suitability, the benefits of trickling filter technology include lower running and operating costs, and requires reduced energy input. It is simple to use and actual maintenance itself is much lower.

"All of these contribute to minimal costs over the plant's lifespan," Jeram points out, "and additional benefits include easy recovery from power outages, bio-digestion at a high rate with nominal resource use, less sludge production and minimal operator intervention."

Commissioning took place during November 2015, with Veolia's EC&I manager and technicians, along with CLN Nacala Corridor Project

contract manager, supervisors and operators. "Post-commissioning required three days of training for the client's personnel, which included covering the contents of Veolia's operating and maintenance manual," Jeram concludes.

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or go to www.veoliawaterst.co.za



The plant services the port's administrative block, replacing septic tanks previously used by the client

CHEMICAL TECHNOLOGY: WATER PROBLEMS AND SOLUTIONS

As we enter the latter part of 2016, it is now even more imperative that our magazine, 'Chemical Technology' focuses on those matters of greatest urgency for the future, not only of our country, but of the world. The magazine will therefore be concentrating on providing a platform for investigation into the problems and solutions to this worldwide crisis.

The World Wildlife Fund-SA states in its 2014 Report, 'Understanding South Africa's most urgent sustainability challenge': "We live in an interconnected, interdependent world. This idea, of intersected systems that underpin our natural world and couple resources has gained currency in recent years . . . WWF encountered exactly this 'nexus' phenomenon when [it] prioritised the need to understand and build awareness of the confluence of food, energy and water resources and the implications for development and planning in South Africa." The Food, Energy, Water (FEW) Nexus Report demonstrates the state of the resources at the centre of which is Water.

The challenges presented by the state of both the availability and the quality of water in South Africa constitute serious constraints on the country's development. Pertinent in the extreme for ChemTech is the matter of ongoing deterioration of water quality.

We shall be publishing topical articles on water's role, highlighting solutions to the problems facing us, which are unfortunately becoming ever more critical with the ongoing effects of climate change.

Allied to the water-energy synergy are the subjects of renewable energy production, and the achieving of sustainable energy provision in the country. A report by the Energy Research Centre of the University of Cape Town in 2013 stresses the inextricable link between water use and energy supply.

Future features

Thus our feature articles will hone in on the efforts to find workable solutions for the following challenges, to name but a few:

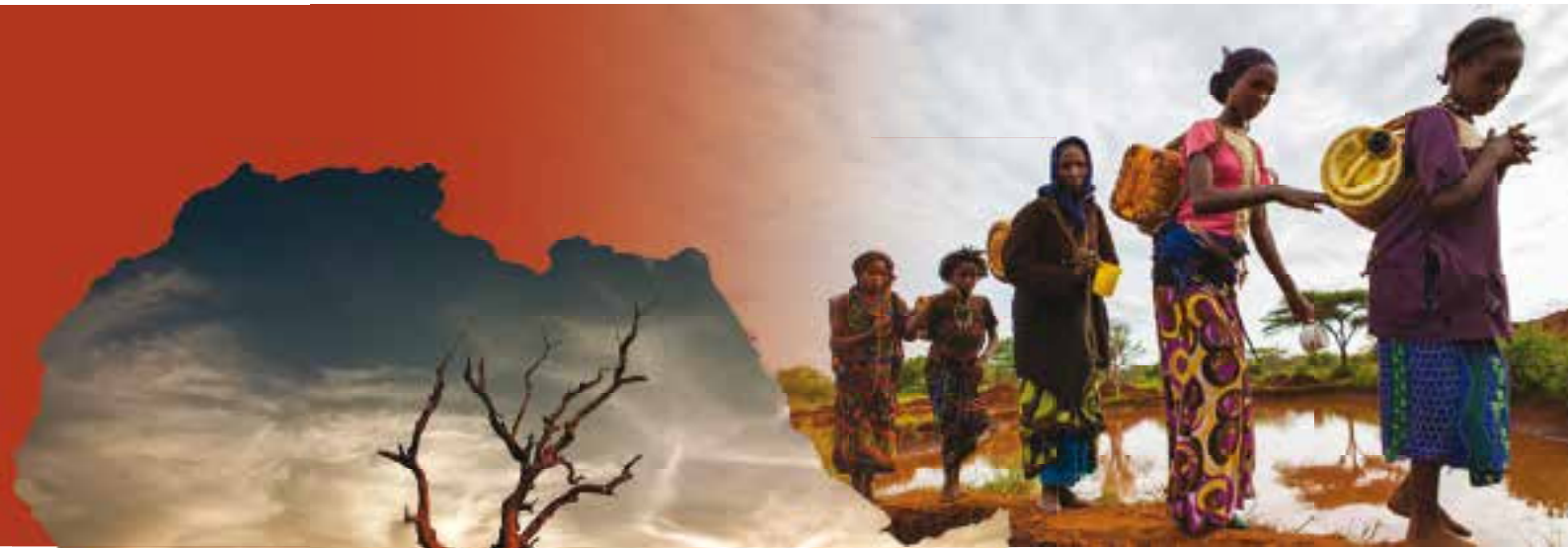
- A better understanding of the role of energy in the water value chain – pumping, transportation, treatment, desalination, irrigation,
- Ion technology – electrochemical desalination for brackish water
- Water resource toxicity – bacteria (Mission 2017)
- Decentralised water distribution systems: wells, pumps, rainwater collection tanks
- Public-Private Partnerships (PPP)
- Acid Minewater Drainage (AMD)
- Mining and water management (METS)
- Reclaimed minewater for clean drinking water and treatment of grey water for re-use
- Water risks/water quality concerns such as eutrophication, acidification, sedimentation, salinisation, and microbial pollution
- Water footprints
- Ultraviolet and ozone disinfection
- Non-hazardous chemical treatment
- Ultrafiltration and membrane bioreactors technologies.

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Talking turbine testing

by John Evans, diagnostic manager, WearCheck, South Africa

This article discusses a variety of turbine sample tests: how they are conducted, and what information they provide. The test results enable the best remedial action to be taken for the component in question, in turn boosting the reliability of the turbine by maintaining the oil (which is often a large financial investment) in peak operating condition.

Oil analysis test slates (testing profiles) follow a pretty standard format when it comes to mobile equipment, buses, trucks and bulldozers, for example. Oil wetted components can be divided into engines, clean oil systems (hydraulics, transmissions and compressors) and drivetrain components (differentials, gearboxes and final drives). The sort of tests carried out would involve, spectrometric analysis of wear metals, additives and contaminants, viscosity at various temperatures, ferrous density (PQ), water, TBN, TAN, particle counting, fuel determination, infra-red analysis for soot, oxidation and acids and microscopic particle examination. This is actually a fairly narrow range of tests, but they have a very wide applicability which is why they are used for the majority of samples that come into a commercial oil analysis laboratory; they will, in fact, provide a comprehensive service for about 95% of the samples analysed.

The ASTM manuals for petroleum product testing can be obtained on a CD that runs to more than four gigabytes and contains thousands of test methods. Obviously, most of these tests are highly specialised and only have niche applications. However, when they are needed they are very important.

A class of samples that requires quite a few specialised

tests are those that come from gas and steam turbines. The usual suite of tests is carried out and includes spectrometric analysis, viscosity at both 40°C and 100°C, water (by Karl Fischer titration), particle counting, TAN, PQ and debris analysis. Let us take a look at these more common tests first and discuss their importance.

Spectrometric analysis (ICP spectrometry) involves heating the oil to a very high temperature where the individual atoms in the sample radiate light of a frequency specific to the particular element of interest. The strength of the light is proportional to the concentration of the element. This test provides information on wear metals which can give an indication of the onset of an abnormal wear situation, additives which allow the analyst to identify and/or confirm the oil in use and the levels of contamination (airborne dust and dirt being the most common.)

Ferrous density (PQ) is a bulk magnetic measurement of the oil carried out by seeing how much the oil sample disturbs a fixed magnetic field. This can give an indication of more severe wear situations that generate particles larger than the ICP can detect.

Viscosity is the measurement of the oil's resistance to flow and is measured by timing how long it takes for an oil





Foam presence and stability testing

sample to flow through a tube. Knowing the viscosity helps identify the oil. Unexpected changes in the viscosity can indicate deterioration of the lubricant; a sharp increase may indicate oxidation and breakdown of the oil.

Water is a common contaminant and is measured by an electrode during a titration that is very accurate and can measure water concentration down to less than 0,001 %. Water contamination can cause severe oil degradation and can act as a source of oxygen which causes rapid lubricant breakdown. Water is also responsible for corrosion and spongy hydraulic action.

Particle counting (ISO 4406) measures the total number of particles in the oil without actually identifying them. The oil is allowed to flow between a laser and a detector and particles of various sizes cast shadows on the detector that are interpreted as the number and size of solid particles in the oil. This gives an indication of the oil's cleanliness; the cleaner the oil, the longer and more efficiently the turbine will operate. Approximately 75 % of all premature failures in clean oil systems are due to particulate contamination and 90% of these are due to abrasive wear. Measuring oil cleanliness and keeping oil clean is vitally important.

TAN (Total Acid Number) is also measured by an electrode

during a titration and gives a measurement of the acidity of the oil (sort of like a pH). As the turbine oil degrades and ages, the acidity of the oil will increase, so this test can give an indication that oil might need changing or sweetening.

MPE (Microscopic Particle Examination): This test is only carried out if the PQ, ICP or particle count results are very high. The oil is filtered through a five micron membrane and any debris present is examined under a microscope.

This covers the standard tests that are usually carried out on most 'clean oil' system samples. The following tests are the specialised tests that give vital information regarding the health of the turbine and its lubricant.

VPR (Varnish Potential Rating also known as MPC or Membrane Patch Colourimetry): This test measures the potential for the oil to form soft particles of oxidised oil residues. These can plate out onto internal components changing tolerances and hardening into quite tough



John Evans is diagnostic manager for WearCheck



A laboratory technician measures the VPR of a turbine oil



RULER instrumentation

resinous deposits – which are known as varnish. These are the brownish residues sometimes found in industrial hydraulic samples. Varnish can be responsible for increased wear, valve stiction, filter plugging and poor cooler performance. As a point of interest, API group II and III oils may be more prone to varnish formation than group I oils due to the lower natural solvency of group II and III lubricants. Highly refined oils such as group II and III oils can be thought of as group I oils with the undesirable components refined out of the oil. This increases the stability of both oxidation and viscosity of these oils but unfortunately, the ‘undesirables’ are natural solvents for varnish.

The oil sample is mixed with a solvent and then filtered through a 0,45 micron cellulose membrane. The colour of the patch is then rated against a standard reference scale which runs from 0 -100 with 0 representing no varnish potential and 100 representing a severely degraded oil. This is not quite as simple as measuring how ‘dark’ the membrane is – the separate component ‘colours’ are measured (think of this as an RGB measurement). Three values are determined and a mathematical model converts these to a VPR index. Extra information may be gleaned from knowing the

individual readings and give an indication of the chemistry taking place in the oil.

RULER (Remaining Useful Life Evaluation Routine): This test involves applying a voltage to the oil mixed with a suitable solvent. The electric current in the solution is then measured. In effect, the sample is given an electric ‘shock’ and the voltage of the shock is slowly increased until the anti-oxidant additives in the oil start to respond. ‘Stronger’ anti-oxidants will react to larger applied voltages more strongly than ‘weaker’ anti-oxidants. So, not only can the RULER evaluate the amount of active additive left by the size of the reaction to the applied voltage, it can also measure the activity of different types of anti-oxidants. The amount of these active additives in the oil is a very good indication of the remaining useful life of the oil.

A sample of unused oil is required and the value of the used oil is expressed as a percentage of additives in the new oil. Three values are given, a total value and two sub-values for both the phenol and amine classes of compound. Note that the total value is not a summation or average of the two sub-values.

The loss of anti-oxidants leads to the oxidation of the oil with concurrent build-up of acids, varnish, lacquers and resins. The viscosity and the TAN of the oil will also increase.

Air Release: This test measures the time taken for the oil sample to release a specified amount of air under predetermined conditions. Entrained air that is not readily released from the oil can lead to spongy hydraulic action, inability to maintain oil pressure, incomplete oil films and the acceleration of oxidation of the oil.

The oil is heated to either 25° C, 50° C or 75° C depending on the viscosity of the oil. As most of the samples analysed are going to be ISO 32, 46 or 68, the temperature will be 50° C. The oil is heated to the test temperature and a sinker is placed in the oil and its density (mass) is measured. The sinker is then replaced with an air inlet tube and air is bubbled through the oil. As air becomes entrained in the oil the apparent density of the oil will be reduced. After a set period of time, and a defined temperature and flow rate, the air source is removed and replaced with the original sinker. The sinker will now appear to ‘weigh’ more as the medium in which it is suspended now has a lower density. The time taken for the sinker to return to its original weight is measured.

Demulsibility: This test measures the ability of the oil to separate from water. Trace amounts of water will dissolve in turbine oils (50-100 ppm) but free and particularly emulsified water can do a large amount of damage. Water contamination can lead to corrosion, accelerated oxidation, film strength loss, cavitation and filter plugging.

Forty millilitres of the oil sample is mixed with 40 ml of distilled water and agitated to form an emulsion; again temperatures and mixing times are controlled. The test takes place in a graduated cylinder so the levels of water/oil/emulsion can be noted. The test mixture is allowed to stand for 15 minutes then the three levels are measured in millilitres. The results are reported as X/Y/Z (Min) where X is the millilitres of oil, Y is the millilitres of water and Z is the millilitres of emulsion; the test time in minutes is also noted. Complete separation would result in values of 40/40/0 (15);

note that X+Y+Z must always equal 80.

Foaming: This test measures not only the ability of the oil to form a foam but also the stability of that foam. The foaming tendency is the amount of foam formed on the completion of the test and the foam stability is how long it takes for the foam to collapse. 200 ml of oil is heated to 24 °C and placed in a graduated cylinder. Air is then bubbled through the sample under controlled conditions and after five minutes the volume of foam is measured (ie, from the surface of the liquid oil to the top of the foam level). After ten minutes the volume of foam is again measured; this gives a measure of foam stability.

The test is then repeated at 94 ° C (24 ° C and 94 ° C are 75 ° F and 200 ° F) and the same two measurements made at the end of the aeration step and again after ten minutes.

The sample in step two is allowed to cool from 94 ° C to 24 ° C and any remaining foam is collapsed by stirring. The test is then repeated for a third time.

The results are reported in millilitres as X1/X2 Y1/Y2 Z1/Z2 where X1 is millilitres of foam formed and X2 millilitres of foam left after ten minutes at 24 ° C. Y1/Y2 measure the same thing at 94 ° C and Z1/Z2 also measure the same after the Y sample has been allowed to cool back down to 24 ° C and the test repeated. The dangers of foam formation are the same as for poor air release values.

RPVOT (Rotating Pressure Vessel Oxidation Test): Essentially, this measures the same thing as the RULER, but RULER is very, very much quicker. It is also cheaper and easier to do and can be done on a very small sample of oil. The RPVOT on a new oil, used to determine a baseline, would take more than 12 hours to complete.

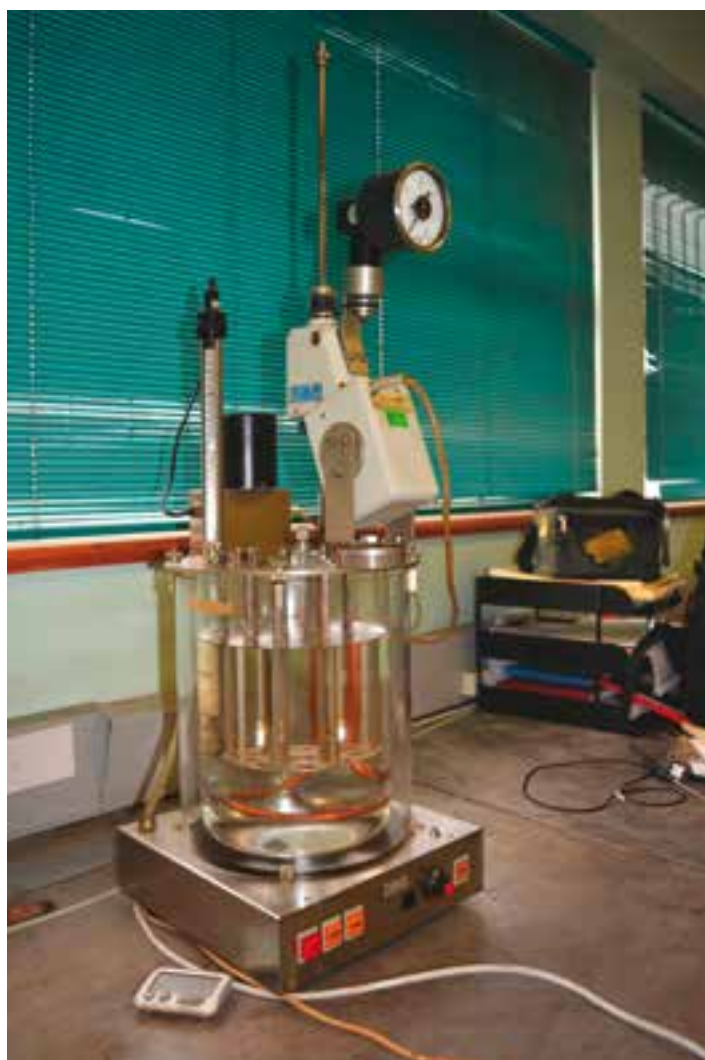
A sample of the oil is placed in a pressure vessel along with water and copper wire that act as oxidation catalysts. The whole system is pressurised with oxygen and the reaction vessel is rotated in a water bath at a constant temperature. The pressure in the vessel is monitored and should stay more or less constant as the anti-oxidants in the oil retard the ability of the oxygen to react with oil in a runaway chain reaction manner. Eventually all the anti-oxidants will get used up and an oxidative chain reaction will start with the oil now taking up large volumes of oxygen. This will result in a sharp drop in the pressure of the reaction vessel and it is the time that this takes to happen that is measured.

These specialised tests obviously cost more to carry out and take longer to process. RPVOT testing could take a few days to carry out but all are critical to the good maintenance of gas and steam turbines which now operate under more extreme conditions than ever before (higher speeds and pressure with tighter tolerances). Some turbine sumps could run to tens of thousands of litres of oil and this represents a valuable asset that needs to be maintained at peak operating condition.

The major problems that are encountered are degraded oil and varnish in gas turbines and cooler leaks in steam turbines. Experience shows that foaming (as opposed to air release) is also an issue on all types of turbines. If test results are unacceptable then this gives the maintenance department early warning of an impending problem and remedial action can be taken. Ideally, the full suite of tests should be carried out on an annual basis, RULER twice a

Table 1: Testing frequencies

Test	Monthly	Quarterly	Semi-annually	Annually
ICP	*			
PQ	*			
Viscosity	*			
Water	*			
Particle count	*			
TAN	*			
MPE	*			
VPR/MPC		*		
RULER			*	
Air release				*
Foaming				*
Demulsibility				*



Test apparatus

year and VPR quarterly. The extra cost is a small investment in terms of keeping valuable industrial equipment running and looking after thousands of litres of oil.

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With a geographical footprint spanning 100 countries, UK-based safety product manufacturer Brady is in the process of expanding this impressive reach across Africa, by teaming up with North Safety – a well-established and trusted regional distributor.

For more than a century, Brady has been recognised as a specialist in the manufacture of lock-out and tag-out systems, safety labels, printers and scanners, safety software, and spill control and containment kits. The company's product range is distributed globally to industries that include; oil, gas and petroleum; mining; food and beverage; and metal processing plants.

Due to the fact that Brady specialises solely in manufacturing, it relies on a network of distribution partners that deal directly with the end-users. Brady business development manager for South Africa and Sub-Saharan Africa, Paulo Morais Neves states that the company selected North as a regional distributor in late-2014, due to its

proven track record and excellent reputation in the industry.

"We have had a presence in Africa for the past three years, however, our customer base has grown to such an extent that we could not manage to support all of them. Our strategy was to partner with North to complement our existing partners and set up local distributors, who are more aware of the culture, social life and the local way of doing business," he explains.

North's Johannesburg and Durban branches presently stock the full range of Brady products. "We are currently negotiating minimum stock orders and levels for a number of products in all North branches. North and Brady are a good match, as both companies uphold the same values, and there is a mutual understanding as to how each operates," Morais Neves adds.

North supplies a wide range of personal protective equipment (PPE) and safety products to industries in Sub-Saharan Africa,

with branches in South Africa, Mozambique, Zambia, the DRC and Kenya, and plans to expand into West Africa. According to Morais Neves, this ensures that local product delivery, support and overall customer satisfaction is dramatically improved.

"North has forged longstanding partnerships with local and international associates, while Brady's solutions improve the safety of everyone working in the harshest of environments. Our relationship with North has proven to be effective to date, and I am confident that we will achieve success in increasing our footprint as the relationship progresses from strength-to-strength," he concludes.

For more information contact:

Lizette Kasselmann on tel: +27 31 705 6085; email: marketing@northsafety.co.za; or go to www.northsafety.co.za

Versatility and high performance in one powerful oscilloscope

TEKTRONIX, the world's leading provider of test, measurement and monitoring instrumentation has introduced the new MDO4000C oscilloscope that includes up to six built-in instruments, (spectrum analyser, arbitrary/function generator, logic analyser, protocol analyser and digital volt meter/frequency counter).

The MDO4000C Series, when configured with an integrated spectrum analyser, is the only instrument that provides simultaneous and synchronised acquisition of analogue, digital and RF signal analysis, ideal for wireless communications in IoT and EMI troubleshooting. The MDO4000C is completely customisable and fully upgradable. Typical applications for the MDO4000C oscilloscope are:

- **Embedded Design** Discovers and solves issues by performing system level debug on mixed signal embedded systems including today's most common serial bus and wireless technologies.
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mining which time domain signals may be causing unwanted EMI. Observations in real-time of the effects time domain signals have on system EMI emissions.

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able. Add the instruments initially or at a later time. A new Total Protection Plan is available to protect users' investment, even from accidental damage.

Tektronix is represented in South Africa by Comtest.

For more information on the new Tektronix 6-in-one MDO4000C oscilloscope, or information about seminars, demos or to locate the nearest dealer, contact Comtest on tel: +27 010 595 1821 or email: sales@comtest.co.za



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FOCUS ON PLANT MAINTENANCE, SAFETY, HEALTH AND QUALITY

Goscor Cleaning Equipment formalises Namibian dealership agreement



Taurus Maintenance Products showcased a range of equipment from GCE such as the Tennant T2 and T3 scrubber dryers, at the 2016 Mining Expo & Conference in Windhoek, Namibia

In a strategic move to expand its African footprint, South Africa's leading quality cleaning equipment and service solutions supplier, Goscor Cleaning Equipment (GCE), has formalised its partnership with Namibian-based dealer, Taurus Maintenance Products Namibia (Pty) Ltd.

Established in 1981, Taurus is one of Namibia's leading suppliers of cleaning products and equipment to a wide range of industries: contract cleaning, hospitality, mining, construction, public service, health care, automotive, agriculture and retail.

Taurus was enlisted by GCE as its dealer on an ad-hoc basis in the neighbouring country for a number of years. "The formalisation of the dealership relationship stems from this successful long-term association between the two companies," explains GCE Managing Director, Greg Venter. "This has culminated in an objective for South African clients in Namibia to see the companies as one with a shared business ethic, namely to provide outstanding cleaning solutions."

"We have strategically aligned our range of world-leading brands such as Tennant, Ghibli and Elgin with Taurus," continues Venter. This means that our Namibian market benefits from products such as the Tennant scrubbers and driers including the battery operated Tennant 7080 ride on scrubber that features a 710 mm/28-inch cleaning path and compact frame."

He also notes that Taurus supplies Green Machines to its market and that roping in a likeminded distributor for GCE in Namibia ensures that customers in the neighbouring country get the same service from Taurus as they would from GCE.

"An added benefit also includes us tapping into our client base that is now working in Namibia as Taurus is able to offer the after-sale services and maintenance on equipment supplied," adds Venter.

For more information contact:

Greg Venter at email: gventer@goscor.co.za



Water is a vital resource requiring careful management throughout the process.

Water is our life

Endress+Hauser assists with technical and process support having expert experience and knowledge of the standards within the water and wastewater industry. Furthermore Endress+Hauser offers high-quality solutions that will increase plant efficiency and optimise operational costs.

Endress+Hauser South Africa is well established in all areas of water and wastewater treatment with a network of global support. These competencies include monitoring the quality of water bodies, drinking water treatment and distribution thereof. As the various regions in South Africa are running out of surface water to use for drinking water, coastal towns and cities will turn to desalination of sea water where inland towns and cities will turn to water-reuse to supplement their water supply.

Use of membrane filtration is key to these water supply solutions and Endress+Hauser has proved to be a reliable partner to various membrane plant builders, whether in desalination or water re-use. The company has a large footprint in treatment and optimisation of municipal as well as industrial waste water. Robust, reliable and user-friendly measurement technology is essential to the reliable operations of water works and sewage treatment.

The modern portfolio of measurement devices makes it possible to find the ideal solution for all types of applications from one single source. Platform technologies such as Proline (flow), Liquiline (liquid analysis) and Cerabar (pressure) offer a host of benefits for planners, system integrators, operators as well

as service personnel. These include reduced complexity due to standardisation of similar measuring points, easy multiplication of device settings for comparable measuring points reducing time, potential for errors and optimising stock-keeping of modular replacement parts for device platforms.





Select early in the design stage

The correct selection of your measuring points starts at the design stage of your project. As part of the Endress+Hauser industry focus and expertise, assistance and consulting services can be supplied early in the project stages.

This will assist in selecting the correct and most cost-effective solution from their extensive and flexible product basket. Also included is the selection of the most suited measurement principal to a particular process as well as selecting the correct segmented product according to required features and capabilities, such as advanced diagnostics.

Endress+Hauser can also supply the complete solution to the loop by offering surge arresters, power supplies and displays. Smart system components such as data managers and loggers complete the measurement basket and allow

smart solutions in respect of data storage, individual preference for I/O types, quantities and linking to various communication protocols. These include HART, WirelessHART, Profibus, Foundation Fieldbus and Ethernet.

As energy consumption forms a large part of the overall operating cost of a wastewater treatment plant, it is of utmost importance to monitor this continuously. The transparent presentation of energy consumption needs to be broken down into individual processes in order to benchmark the energy optimisation.

Endress+Hauser has developed a smart energy monitoring solution for sewage treatment plants based on the advanced and improved Memograph RSG45. As an energy manager, the RSG45 collects, calculates and visualises the defined key performance indicators of the plant.



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In conjunction with the intuitive Field Data Manager software (FDM), remote access and further processing becomes very easy to implement.

Energy monitoring offers:

- optimised plant performance
- increased pump efficiency
- monitoring electricity generation (where biogas is used)
- improved aeration performance
- customised KPIs.

All parameters in view Endress+Hauser offers an elegant way to combine online analytics and sampling in a single system. The basis for this innovation is the Liquiline CM44x multichannel transmitter, which not only supplies the analytical sensors, is also the core electronic component of the CSF48 sampler series. A single Liquiline transmitter can control sampling programs as well as up to four additional online parameters simultaneously.

The Liquistation CSF48 sampler can be easily converted into a smart, reliable measuring station by linking up to four freely selectable analysis parameters.

Safe and cost-effective aeration control

Using online analysis can improve performance. The combination of oxygen, ammonium and nitrate measurement with load-dependent aeration control can help operators to improve plant performance through reducing emissions and improving safety and energy efficiency.

Reliable removal of COD and nutrient load is essential. This makes efficient plant operation necessary in order to allow oxygen input and non-aerated periods to finalize the nitrogen removal through denitrification. Monitoring the exact amount of the aeration's energy consumption is critical to managing overall energy costs

effectively. Biological wastewater treatment is a core process in any modern sewage processing plant. It involves the decomposition of organic loads and nutrients that can cause eutrophication in downstream water bodies. Aeration of the aerobic treatment step is, however, a major cost factor, with at least 50 % of electrical energy being consumed here alone.

It has already been proved by many operators that a strategically implemented aeration control system can significantly improve both effluent discharge values as well as energy consumption.

In many places phosphate precipitation is also necessary, but this also represents a significant cost factor. Load-sensitive phosphate precipitation is an effective solution for cost-efficiency and safe phosphate discharge levels.

Liquiline Control CDC81

The Endress+Hauser load-sensitive controller, Liquiline Control CDC81, using ammonia and nitrate levels in the process, aims to achieve safe effluent levels as first priority and also to reduce energy consumption significantly. The controller can be rapidly commissioned and supplies identical HMIs for up to three biological treatment zones. It provides real time control, fieldbus communication, failure-safe modes according to process impact, data logging, event and alarm messaging.

The Liquiline Control CDC81 is able to control and optimise continuous aeration, intermittent aeration as well as precipitant dosing for phosphate removal,

Further support services

A 24/7 service helpline is there to support you and give you required assistance in order to minimise your downtime. This can be telephonic assistance or on-site diagnostics or repair. Engineering, commissioning, traceable calibrations, maintenance and expert product training are also available.

Only a clear picture and detailed knowledge of the installed instrument base can act as a solid foundation for a predictive maintenance and optimising strategy for your plant. Whether you need to find information concerning spare parts, verify software versions, trace instrument history records on the basis of key events or view the plant database with its installed instruments – the data must be up-to-date and rapidly available.

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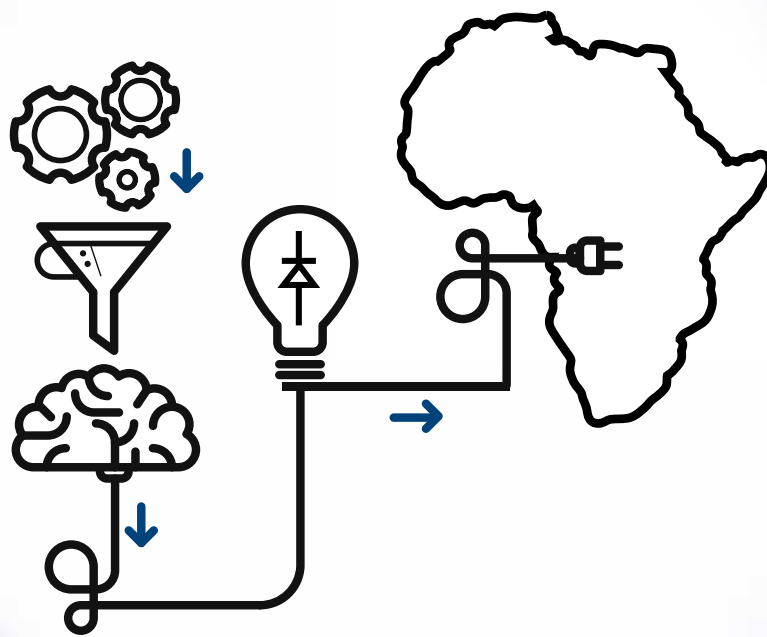
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SACAC launches new website



The South African Council for Automation and Control (SACAC) recently launched a new website (www.sacac.org.za), and will form the basis of a more efficient communication strategy to add value to its members. It is envisaged that the website will play an important role in ensuring that members are kept up to date with future events and that queries and recommendations can be responded to quickly.

Future SACAC events

• Observer Design workshop

An Observer Design workshop will be hosted by Derik le Roux at the University of Pretoria on 12 August 2016. This workshop will discuss the tools available to an engineer to design linear and nonlinear observers for industrial processes.

• Automation and the 4th Industrial Revolution workshop

A workshop on Automation and the 4th Industrial Revolution will be hosted by Prof Ian Craig and Laurentz Olivier at the University of Pretoria during September 2016. More details will follow closer to the time.

• Nonlinear Optimisation workshop

A workshop on Nonlinear Optimisation is planned for 2016. The Workshop will be presented by Dr Otis Nyandoro and will discuss the principles necessary to apply nonlinear optimisation in practice. More details will follow once the date has been set.

IFAC News

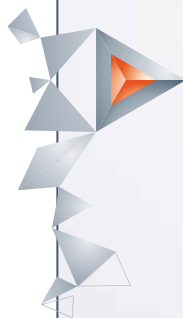
Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing

The 17th IFAC Symposium on Control, Optimization and Automation in Mining, Mineral and Metal Processing takes place in Vienna, Austria from 31 August – 2 September 2016.

A detailed programme is available at:
<http://www.ifacmmm2016.org/>

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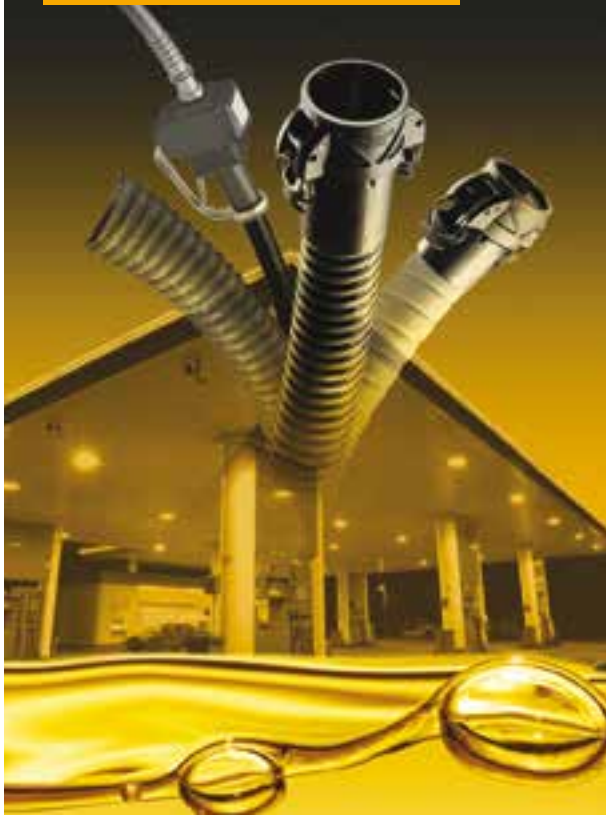
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CONTROL AND INSTRUMENTATION

SoftCo partners with Grant Thornton in SA

According to Grant Thornton's 2015 research of more than 2 500 executives in 36 economies, over half (56 %) of firms surveyed are either already automating business practices or may do so over the next 12 months. In South Africa, research revealed that 31 % are already automating, or will do so in the coming year (Grant Thornton International Business Report on Automation 2015).

To help businesses address these demands to automate operations, Grant Thornton South Africa has partnered with SoftCo, global provider of transformative process automation solutions, to jointly deliver efficient, effective automation solutions to its customers in southern Africa. Grant Thornton will be driving the sales, implementation and support services for SoftCo's market-leading technology on the continent.

"As SA businesses continue to focus on reducing costs, improving efficiency and facilitating compliance, the demand for business process automation solutions which can meet these needs are on the increase," says Ian Scott, managing partner of Grant Thornton Cape. "In this digital age, especially post-financial crisis, businesses are looking to technology at an ever-increasing pace as we strive for greater efficiency and better productivity."

Scott says Grant Thornton is delighted to announce its partnership with SoftCo because the business complements the advisory services which the firm already provides to clients. In addition, the partnership allows Grant Thornton to offer SoftCo's Cloud and Outsourcing solutions to all its clients in southern Africa.

SoftCo is a provider of business process automation software that effectively replaces operational inefficiencies with solutions that increase productivity, reduce costs, while simultaneously helping organisations to meet their compliance obligations. The SoftCo solutions assist with specific compliance requirements such as the Sarbanes Oxley requirements; SA's Protection of Personal Information Act (POPI) which was signed into law in November 2013, but which is currently awaiting the appointment of a POPI Regulator before it comes into force; and the European Data Directive.

SoftCo offers a proven and secure solution for the retention, protection and digital shredding of a wide range of documents and data. SoftCo is a global organisation with offices in Ireland, the UK, the USA, and the Nordics. SoftCo has over 500 000 business users worldwide, is ISO 27001 certified and it is also a Microsoft Gold Partner.

"We are very pleased with our new partnership here in South Africa," says Susan Spence, Co-Founder of SoftCo. "Our collaboration marks an exciting time of opportunity for further growth for our business solutions in southern Africa."

Spence adds that SoftCo's customer-centric approach to understanding the challenges faced by businesses, and being able to provide solutions to these challenges is often quoted as the reason why companies forge long-term partnerships with SoftCo.

For more information contact Ian Scott on tel: +27(0)21 417 8792; or email: ian.scott@za.gt.com; or Vanessa Evans on tel: +27(0)10 590 7200; or email: vanessa.evans@za.gt.com



Engenamic and Wits University drive electrical energy capacity-building

“Energy, and sustainable access to energy (in particular electrical energy), is a great development enabler, enabling other infrastructure and development, industrialization, and economic growth. It also facilitates access to the evolving global “digital or knowledge-based economy”, which access will be key to future African growth and development within the evolving global economic paradigm.”

Ian McKechnie, CEO of management, project and engineering advisors Engenamic, was commenting on the capacity-building programme initiative, dubbed enableAFRICA, that Engenamic is spearheading together with the University of the Witwatersrand.

He further noted that particular challenges are facing the electrical energy sector in Africa. “For example, the continent is vast and characterized by large distances between natural sources of energy and load centers, and deep disparity in the nature and characteristics of the energy grids that will need to be established and interconnected to realize a sustainable energy future for the continent. Furthermore, and notwithstanding the development of grid-based access to electricity, off-grid electrification (and associated “small power systems”) is also a major component (and challenge) in developing access to electricity across Africa. Small power systems include, for example, localised generation (particularly, but not only renewables), and mini/micro grids (localized smart grids).”

McKechnie stated that the aim of

the enableAFRICA programme was to establish and facilitate a collaborative and inclusive pan-African network, aimed at building and unlocking broad-based sustainable capacity in infrastructure development, establishment and operation, through:

- Skills development (technical & non-technical), as key to building sustainable capacity.
- Relevant research and knowledge development, focused towards African needs and priorities.
- Confidence building, through facilitating, de-risking and supporting investment and industry, and through facilitating engineering, technical and project support.

He stated that a key objective of the programme is to build this broad-based sustainable capacity in Africa, for Africa, and (as far as possible) by Africa, and in doing so to synergise with and capacitate existing (and future) organisations, agencies, programmes and projects in a symbiotic manner.

He commented further that the approach adopted in formulating the initiative and associated vision has been an inclusive one. South Africa, the African region (and further afield) are faced by real constraints, including availability of skilled and financial resources as mentioned above. “It is therefore important that the existing facilities and capabilities across the continent be leveraged and mutually supported, and a holistic approach across the three key attributes is

coordinated, integrated, facilitated and supported”.

McKechnie concluded that as the team moves forward to engage with role players across the continent to develop this inclusive enableAfrica initiative further, they are excited and enthused by the potential to meet the challenges and to build sustainable enabling capacity in the energy sector - by Africa, in Africa, for Africa.

For more information contact Ian McKechnie (CEO) on tel : +2712 6634804; email : ianmac@engenamic.com; or go to www.engenamic.com



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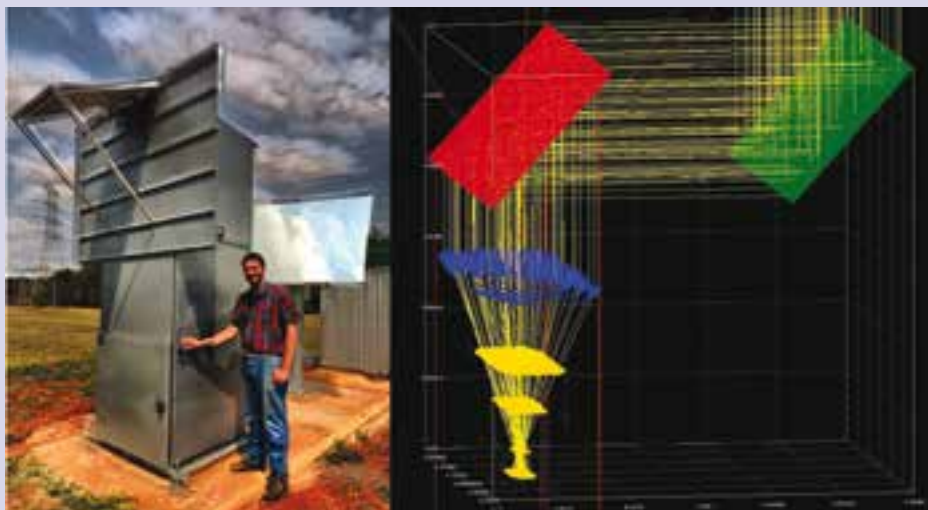
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Go to <http://eskom-bizhub.co.za/ESCo> for more information on qualifying criteria application guidelines and funding details.



Mohlaleng_2833_EI

The GAP Innovation Competition



Dr Badenhorst with the operational platform and the design model.

The GAP innovation competition (now in its 4th year) awarded its best innovators and entrepreneurs across the country on 20 November 2015 at The Innovation Hub. The types of awards were for the Biotech Fundi Awards, and the Gauteng Accelerator Programme (GAP) Innovation Competitions Awards, which consisted of four categories: Medical, ICT, Green and Biosciences.

Dr Heinrich Badenhorst (Senior Lecturer, Department of Chemical Engineering, University of Pretoria) was awarded third place in the GAP Green category for his team's small-scale solar concentration system. The other team members included Johan Bester, a Masters student. The third prize in this competition included incubation services from The Innovation Hub's Maxum Business Incubator and CIC, R100K in seed funding and a R20K cash award.

ML: How did hear about the competition?

HB/(Team): Via the website and internal announcements

ML: What is your project about?

HB/(Team): We have developed a low cost, solar concentration platform, which uses only off-the-shelf components and achieves concentration ratios in excess of 1 000 suns. This platform is suitable for many applications, ranging from seawater desalination to industrial energy supply and even seasonal energy storage during

summer for winter. The high concentration ratios allow us to achieve very high temperatures, which opens the door to many specialised applications. One such example, which we developed for the GAP Green competition, is the desalination of seawater and purification of contaminated or brackish water. Traditionally solar power is used in evaporators; these systems have low yields, low efficiencies and inadequate purification. Using carbon nano-materials our system allows us to flash-distill the water, yielding clean, potable water from virtually any source with no contaminants, inorganic or biological. Furthermore, the small, modular nature of the platform and its grid-independent power source, make it ideal for rural applications.

ML: What was the motivation for this type of project?

HB/(Team): The field of concentrated solar energy is globally a rapidly growing research area. The ability to store this type of solar energy without the need for expensive batteries, is a major advantage over current photovoltaic systems. In addition, the high temperature heat supply makes the energy available for many uses beyond just electricity generation. Given that South Africa has some of the highest solar radiation fluxes in the world, this is a seriously underutilised natural resource.

If South Africa is to become a world leader in this arena it is critical that we establish inexpensive and flexible research platforms to pursue new advancements

and develop home-grown solutions, which suit our unique context. Clean, sustainable water and energy supply are arguably the most pressing issues facing our country. This work is dedicated to finding practical and economical solutions to these problems.

ML: Where to from here?

HB/(Team): The GAP Green competition is providing invaluable assistance and coaching in bringing our innovation from the lab into the commercial world, a very challenging prospect. We are narrowing our focus on the most profitable aspect of the design in order to bring it to market as quickly as possible. Nonetheless, work is on-going to continue to develop novel and creative applications for the system.

We hope that this is just the start of many years of research on this platform, which will make a real impact on the international stage and lead to many beneficial consequences for the local community and economy.

ML: Any advice?

HB/(Team): Go for it! No matter how conceptual the design or concept is, you can benefit from the GAP Green programme. It has definitely taught us to approach innovation in a different light: not only seeking to develop novel solutions to a problem but also to create a marketable and cost-effective product, which will be locally endorsed and utilised.

Connect with Dr Heinrich Badenhorst and team

Email: carbon@up.ac.za

Link: <http://www.up.ac.za/en/institute-of-applied-materials-iam/article/2215571/bulk-carbon-materials>



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SAIChE IChemE News

The SAIChE IChemE AGM was held on the 20 April 2016 in Johannesburg. The President, Dr Dawie van Vuuren, welcomed the attendees, relayed apologies, and the minutes from 2015 were approved. Dawie thanked the council members, the executive committee and the secretariat of SAIChE IChemE for their contribution to the institution as well as for their effort towards helping compile the annual report.

This report was presented to the attendees at the AGM which consisted of summaries, for example, on membership, CPD accreditation and branch news. Thereafter, Dr Lizelle van Dyk, presented the financial statements. Permission was granted by attendees for the statements to be published on the SAIChE



Council members: Kevin Harding, Lizelle van Dyk, David Lokhat, Elly Obwaka

IchemE website, and the re-appointment of the auditors for the next financial year was approved. The evening was closed off with a Q&A session, followed by light snacks.

Please note that the AGM will now be during this time of the year because of the new financial year, which is a result from the merger with IChemE.

The Silver Medal Awards for 2015 (top graduating Chemical Engineering students) were: Mr Alexander

Gerhard Johannes (UP); Mr Dewald Oosthuizen (US); Mr Rowan Michael Dalton (UCT); Mr Michael Gustavo (WITS); Mr Kashmeel Bisseru (UKZN); and Ms Shreshtha Singh (DUT).

We would like to thank everyone for attending the AGM, and encourage our members to participate in their local branch activities.

Written by Michelle Low on behalf of SAIChE IChemE Council.

Dust-tight mobile drum tipper

A new TIP-TITE™ Mobile Drum Tipper allows dust-free transfer of bulk materials from drums into process equipment and storage vessels.

Ready to plug in and run, it is mounted on a mobile frame with quick-action floor jacks for stable operation anywhere in the plant.

A hydraulic cylinder raises the drum carriage which seals the drum rim against a discharge cone, after which a second hydraulic cylinder tips the carriage-hood assembly and drum, stopping at a predetermined dump angle of either 45, 60 or 90 degrees with a motion-dampening feature.

As the assembly approaches its fully-tipped position, the outlet of the discharge cone mates with a gasketed receiving-ring inlet fitted to existing process equipment or to the lid of an optional hopper with integral pneumatic, tubular cable or flexible screw conveyor, creating a dust-tight seal.

Once the discharge cone is seated against

the gasket, a pneumatically-actuated slide gate valve opens, allowing material to enter the receiving vessel.

The unit accommodates drums from 114 to 208 litres weighing up to 340 kg and measuring 91 to 122 cm in height.

An optional pneumatically-actuated vibrator on the discharge cone promotes complete evacuation of non-free-flowing materials.

The drum tipper is available constructed of mild steel with durable industrial finishes, with material contact surfaces of stainless steel, or in all-stainless steel finished to food, dairy, pharmaceutical or industrial standards.

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

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Steenkampskraal expected to be the lowest cost producer of thorium worldwide

Steenkampskraal Thorium Limited (STL), through its associate company Thor Energy, is the only company in the world manufacturing and qualifying thorium-containing fuels for use in Light Water Reactor (LWRs), and is developing important intellectual property in the process.

Thor Energy will complete the five-year qualification procedure of the pellet fuel in 2018 and then plans to commence the licensing and commercialisation of thorium fuels. STL owns about 12,50% of Thor Energy AS in Norway. Thor Energy's programme is to manufacture and qualify thorium-containing fuels for use in the Light Water Reactors (LWRs) which constitute the majority of the world's nuclear reactors.

Trevor Blench, chairman of STL, says the company has also made significant progress with the overall design of its HTMR-100 small modular pebble-bed reactor and the designs of several important components. These include its core structures, the reactor pressure vessel, the steam generator, the double-set isolation valves and the fuel loading and unloading devices. "We have prepared a detailed

project plan and a schedule to proceed to a generic design assessment. We have also made progress with the design of a pebble press laboratory to produce fuel spheres. Preliminary discussions have been held with the National Nuclear Regulator about the licensing of our reactor design," he says.

"STL is also designing a factory to make the pebble fuel for this helium-cooled pebble-bed reactor. Thorium has physical properties that make it a better and safer fuel than uranium."

He said the HTMR-100, which is a Generation-4 reactor, is intrinsically-safe. "This type of gas-cooled reactor cannot melt down like the water-cooled reactors."

The first thorium fuel pellets were inserted into the Halden reactor in Norway in April 2013 and have now completed three years of a five-year qualification programme. Blench said the thorium fuel mixtures are demonstrating improved performance and safety characteristics. Thor Energy manufactured a second batch of thorium/uranium fuel pellets in November 2015 and inserted this second batch into the Halden reactor in December 2015.

"The Korean Atomic Energy Research Institute (KAERI) which joined the Thor Energy consortium in 2015 made a significant financial contribution to the project and sent several fuel samples from South Korea for testing in the Halden reactor," he said.

Blench said progress at the Steenkampskraal rare earth and thorium mine is proceeding well. The

latest mineral resource estimate indicates the presence of 11 700 tons of thorium in the Steenkampskraal deposit.

He said that interest in thorium as a nuclear fuel continues to increase. "In October 2014, the Colorado School of Mines published a report entitled 'Thorium: Does Crustal Abundance Lead to Economic Availability'. This report considers the possibility that thorium could be used as a nuclear fuel and that the demand for thorium could eventually rise to nearly 4 000 tons per year."

The report includes studies of where this thorium would be sourced and states that the Steenkampskraal mine in South Africa will be the lowest cost producer of thorium in the world, with an estimated production cost of US\$3,56 per kilo. The second cheapest producer has an estimated production cost of US\$7,98 per kilo and the third cheapest a production cost of US\$8,01.

Blench said the Group's first revenue stream will begin with the sale of the rare earth products. Later, STL plans to earn revenue from the sale of thorium for fuel for existing water-cooled reactors and for gas-cooled reactors. STL will also promote its HTMR-100 small modular, pebble-bed reactor.

He said there is strong demand for rare earths that are used to make magnets for motors and electronic equipment.

For more information contact:

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Workers at the Steenkampskraal site

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SUDOKU NO 116

Complete the grid so that every row across, every column down and every 3x3 box is filled with the numbers 1 to 9. That's all there is to it! No mathematics are involved. The grid has numbers, but nothing has to add up to anything else. You solve the puzzle with reasoning and logic. For an introduction to Sudoku see <http://en.wikipedia.org/wiki/Sudoku>

	7	2						
		4			9			3
		1		8	6			
7	3		8					6
			1			3		2
		6						4
	9			3		7		
	6		4		1	8		

Solution for SUDOKU

115

9	3	2	8	1	7	4	6	5
8	4	6	5	9	3	1	2	7
1	5	7	6	2	4	3	9	8
2	8	9	1	4	6	5	7	3
3	6	4	7	5	2	9	8	1
5	7	1	3	8	9	2	4	6
4	1	3	9	6	8	7	5	2
7	2	8	4	3	5	6	1	9
6	9	5	2	7	1	8	3	4



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