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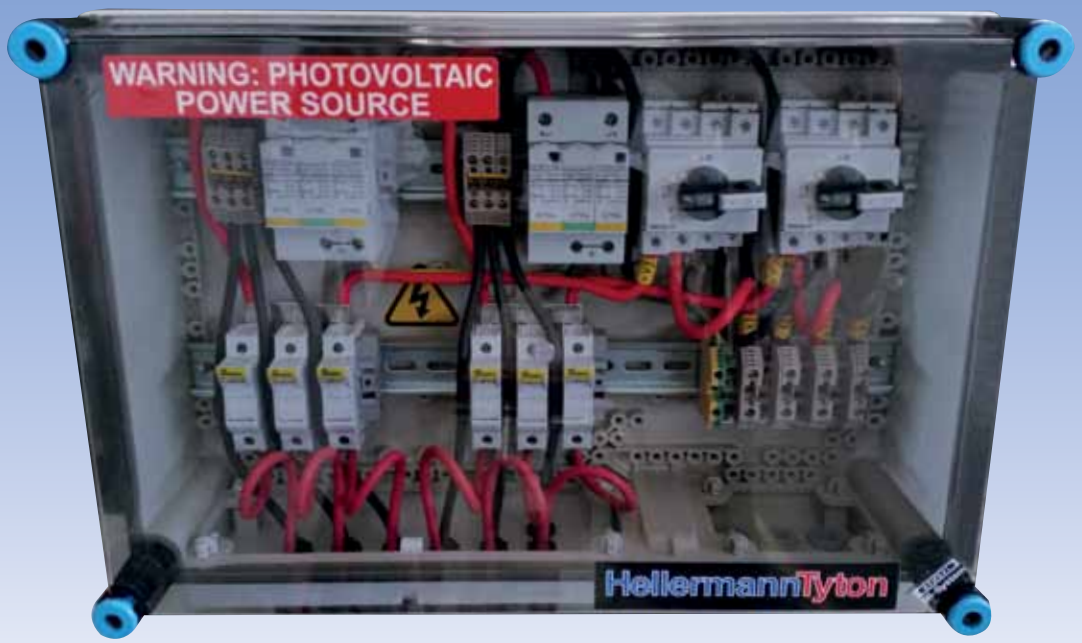

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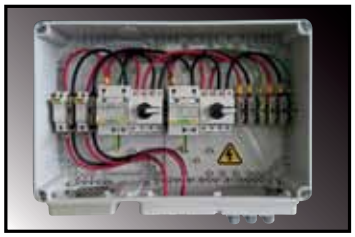

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5906

With March upon us, Mother Nature is getting ready for cooler days and longer nights. With this in mind, dark, cold nights of load shedding are conjured up because the winter months put extra pressure on the grid.

Now, if we had smart grids throughout the country, we would be able to assist Eskom with demand, instead of sitting in the dark.

The 2016 Smart Grid conference was a phenomenal success, and you can read the feedback on page 16.

This issue of **watt**now tackles Safety – which is such a big topic – and safety is needed in EVERY industry.

Our first feature article is on Machine-safety in factory automation. This article gives you insight on how you will be able to increase profits, by just implementing safety strategies in your factory. Read more on page 30.

Another safety concern is electrical hazardous work at the workplace – read more on page 36.

Page 40 sports an article on Renewable Energy, aptly written by Dudley Basson. He discusses the various forms of renewables, a bit of history and new technologies on each.

Richard Dismore wrote a very interesting historical article on the Finsen Time Signal Receiver, which was beautifully restored and is on display in the SAIEE Museum. Read the history behind this on page 52.

As discussed in the last **watt**now, we will be featuring Nuclear articles in every issue of the **watt**now going forward. You will find the first of many on page 60. If you want to get involved and submit an article on Nuclear Power, please feel free to send it to me.

Herewith the March issue - enjoy the read!

Minx

Visit www.saiee.org.za to answer the questions related to these articles to earn your CPD points.

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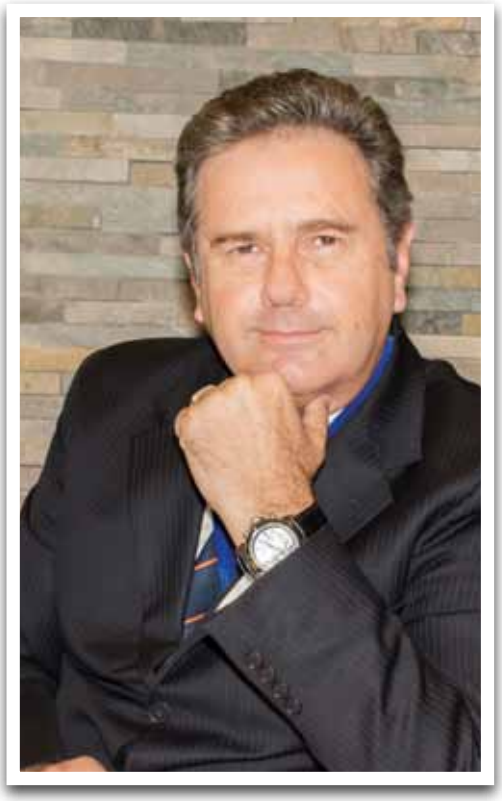


André Leo Hoffmann
2015 SAIEE President

What comes first Public Safety or Competitiveness?

Of interest to Professional Engineers is the recent 'confusion' (I'm not sure how else to politely describe it) of the Competition Commission's rejection of the Engineering Council of South Africa's (ECSA) request for exemption of its professional rules.

The exemption application was filed by the Council for the Built Environment (CBE) on behalf of the Engineering Council of South Africa in April 2014. It refers to exemption for the Identification of Work (IDOW) for which ECSA sought exemption from Schedule 1, and the provisions of Chapter 2 of the Competition Act 89 of 1998, as amended. (The Act).

The Competition Commission evaluated the request, and decided to not to grant an exemption on the bases that the IDOW rules will harm competition in the following ways:-

- It will restrict competition between registered and un-registered persons.
- It restricts competition between persons registered in different professional councils within the CBE.
- It restricts competition between persons registered with the CBE and those registered with professional councils outside the CBE.
- Restriction of competition between persons registered with the CBE, but with different registration categories.

The Commission concluded that the IDOW would reduce the number of persons operating in the market, which would effectively reduce competition. The Commission alludes to other regulations and legislation, which could cater for matters of Public Safety.

I'm not sure what these are. The response goes on to indicate that the Commission found that the IDOW rules are not in line with international best practice. It does not elaborate on this, other than to say that South Africa has opted for a comprehensive approach which totally regulates the engineering profession.

The response does leave an option of appeal open to anyone who has 'substantial interest' affected by the decision. I would guess the public have 'substantial interest' in this matter as their safety is at the mercy of the lowest bidder in any infrastructure project.

I do not profess to be a legal expert or understand the precedence of different Acts in different situations. However confusion in such areas, where it impacts on matters of Public Safety, is somewhat reckless in my view.

Will the Competition Commission take responsibility for the consequences of infrastructure failure, when it occurs as a result of competitive forces using under, or incorrectly qualified, and under experienced design and implementation oversight?

We need to find a way to protect the public interests, and the public's right to a safe and healthy environment, within the context of ensuring fair economic value, and responsibly, enabling the normal forces of competition in any market.

It can be argued that it is reasonable for the public to expect that (at least) public funded infrastructure like roads, bridges, water and sanitation systems, along with electrical supply, is safe for use.

If tested against our Constitution and Bill of Rights, would such an expectation be supported? To take a view that unfettered market forces and competition would be in the best interest of the public is a reckless

assumption, which we know intuitively would be biased in favour of a profit motive.

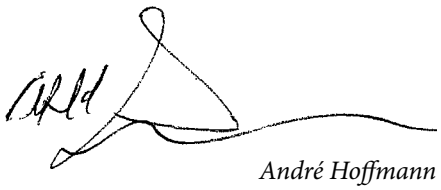
Registration is a choice for a professional, but for those who choose to go that route take on a marque of quality. It gives the public an inherent assurance of a certain standard of performance, and a commitment to practicing ones craft within a framework of a tried and tested system of continued professional development, a code of ethics, and peer review.

To encourage or condone individuals to operate outside their field of expertise, with no inherent guarantee of quality, and where recommendations and decisions affect public health and safety, on the basis of improving competitiveness, is surely inviting trouble.

It may be that some of us are reading too much into this, and that it is just a 'so-what' moment? The Competition Commission looks at market forces and how different organisations may abuse positions of dominance. The Commission thereby strives for equity and efficiency in the South African economy. We, as registered professionals are individuals, and we work in organisations (our own or for others). The organisations we serve have brands and reputations, which are built on quality of delivery and public trust, built up over time. Such organisations are unlikely to compromise public safety for short term commercial advantage by employing incorrect skills within their teams. I am not sure what mandate the Commission has to look at 'competition' between individuals?

That said, and on the surface of it, we may say that common sense is not always so common after all. We will see how these agendas play out. The only profession likely to benefit from this confusion is the legal profession.

Thank you for your support as we continue to #Payitforward



André Hoffmann
Pr. (Tech.) Eng | FSAIEE

WATTSUP

Celebrating Max Clarke's 90th Birthday

The Clarke Family

Friends and colleagues of Max Clarke, together with his wife Eileen, their daughters and their spouses, assembled in the SAIEE Council Chamber on Friday 12th February to celebrate Max as an "nonagenarian" – 90 year old, who is still as fit as a fiddle!

SAIEE President, Andre Hoffman, spoke of the pride and admiration his fellow members had for Max, as well as the impressive work he and his team have (and are doing) preparing the Institute's museum. André presented Max with a framed group photograph of the assembled Council.

All the attendees, including the Chief Executive Officer, Stan Bridgens, referred to the endless enthusiasm and energy Max has for anything he undertakes. Max, we salute you!

From left: Jacob Machinjike, Max Clarke, Andries Tshabalala & André Hoffmann.

From left: Max Clarke, Daughter Liz Posthumus and Arthur Atkins - family friend.

From left: Daphne Atkins and Eileen Clarke.

From left: Alice Makhado and Max Clarke.

Who is 90??

Calling All Unemployed Built Environment Professionals

The Council for the Built Environment Act, 2000 (Act No. 43 of 2000) establishing the Council for the Built Environment (CBE) was passed by Parliament in November 2000 along with the suite of Acts regulating and establishing the six built environment professions:

- Architecture,
- Landscape Architecture,
- Quantity Surveying,
- Engineering,
- Project and Construction Management, and
- Property Valuation.

The CBE, as the regulatory authority of these Built Environment Professions (BEPs), has among others, the responsibility of advising government on human resource issues in the South African BEPS.

In line with its mandate the CBE is calling on all unemployed professionals (registered or not) within these six BEPs to submit their details and credentials.

This information will be used to develop a detailed map of the available skills pool within the country and will provide a valuable source of data when planning for example, interventions aimed at unemployment and capacity development within the BEPs.

Kindly submit the following information to the CBE via email info@cbe.org.za.

1. Full name and surname
2. Nationality
3. Place of residence
4. Latest place, position and duration of formal employment
5. Current period of unemployment
6. List of qualifications and dates obtained
7. Summary of professional experience gained

**Please take note that this advertisement is solely intended as a call for information and by no means does it constitute an offer for any form of employment.*

"Hope begins with you"

The Sunflower Fund enters a new era with the appointment of new Chief Executive Officer, Alana James, who joined the Fund in September 2015, bringing a wealth of experience, global insight and an exciting new operational plan for the organisation.

Alana James

"I am delighted to play a part in the ongoing success of The Sunflower Fund, I'm excited to walk this road with staff, patients and board members," says James. She added that one of the most exciting elements of stewarding the new organisational strategy has been the shift in focus to 'community'.

With this in mind, the Fund is debuting its new tag line: Hope begins with you, reflecting the mission and values of the organisation. With every prospective donor or informed patient, The Sunflower Fund brings Hope to someone's child, someone's parent, someone's friend. Change is good, and along with the new tag line, the organisation has updated its annual campaign. Running from August to the end of September, the highlight is *'Sunflower Day'*, which takes place on 16 September.

James adds that the organisation's iconic bandana has also undergone a facelift: *"Along with our longstanding partner and sponsor, Pick n Pay, we undertook extensive market research at the end of 2015 and realised that it was time to ring in the changes. Earlier this month, we unveiled our new commemorative product known as the Tope – Tube of Hope! An updated version of the bandana, reflecting the renewed enthusiasm and excitement at the Fund, the Tope promises to be a bestseller!"* With its unique design and selection of colours, the Tope is an affordable product with practical functionality for the entire family, and goes on sale in August 2016.

"And that's not all," adds James, *"we are excited to introduce you to some new faces! Please visit our website, www.sunflowerfund.org.za, to meet a new group of characters called 'The Sunflower Fund Myth Busters', who will educate and entertain you when you visit the site. Let us know what you think of our new ambassadors on Twitter or Facebook!"*

James is clearly passionate about growth and impact "Progress is impossible without change and we look forward to achieving our goals with some exciting changes this year".

"Thank you for your continued support and don't forget to save the date, 16th September 2016!" She concludes.

WATTSUP

Vikram Solar expands into 14 additional sub-Saharan countries

The solar company Vikram Solar is partnering with Powertech Africa, a leading African distributor of energy technology, thereby entering 14 new markets in sub-Saharan Africa, including Botswana, Zimbabwe and Tanzania. Vikram already operates local offices in Kenya, Uganda and South Africa.

Vikram Solar, with Powertech Africa as its official sales agent, expects to generate PV module sales of one megawatt in sub-Saharan Africa by May 2016. Drawing on its existing international network, Powertech will be supplying large solar projects and homeowners alike. A leading distributor of Power and distribution electrical solutions in Africa, Powertech Africa is now adding solar technology to its product portfolio.

Darin Mac Allister, General Manager at Powertech Africa, comments, *"Being established energy experts, we have decided to start selling modules, because grid-independent solar installations have become the cheapest and easiest way of satisfying Africa's hunger for energy. The difficult financial situation is making grid expansion extremely slow in this region. In Vikram Solar, we have found a partner that has experience in Africa and meets our exacting quality standards – at affordable prices."* The ELDORA Ultima 60 cell modules with 250 Wp, which will be sold by Powertech Africa, are particularly suited for use at high temperatures, as are routine in sub-Saharan Africa.

The International Energy Agency (IEA) estimates that Africa will achieve a total output of 173 gigawatts from renewable energies by 2040, with solar energy accounting for around 20 percent. According to Solarbuzz, there are currently solar projects in 29 African countries with a potential total output of more than 11 gigawatts.

From left: Neil Bothwick, Vikram Solar SA and Darin Mac Allister, Powertech Africa.

Neil Bothwick, Head of Business Development – Africa of Vikram Solar South Africa adds, *"Powertech Africa was identified as the ideal partner for expanding our presence on the continent. We strongly believe that this partnership will provide another boost to the African solar market."*

Voltex turns Lakehaven Children's Home into a "home where the heart is"

Voltex Durban actively participates in social development projects within their local community and is particularly involved in events that make a positive impact and uplift the lives of children. It is therefore unsurprising that, what initially began as a fun-filled outing for the children of Lakehaven Children's Home, turned into a fully-fledged renovation project.

In August 2015 representatives of Voltex Durban visited Lakehaven Children's Home to make arrangements for a day-outing but following a tour of the home and facilities it was abundantly clear to Ivan Govender of Voltex Durban that whilst the outing would be a delightful experience for these kids – it would not address the desperately poor conditions of the boys' cottage which they called 'home'. *"Our hearts were torn by what we saw as a number of areas in the building presented real safety issues to these boys such as open electrical switches, peeling paint, unsecured windows and so forth"*.

Without hesitation, the Voltex Durban team immediately sprang into action to co-ordinate a complete renovation of the cottage. Together with generous donations, sponsorships and assistance from their various suppliers, partners, customers

EGE Plug And Play Solution Makes Flow Monitoring Easy

The compact plug and play EGE SNS 450 thermodynamic flow sensor provides ease of flow monitoring with low maintenance benefits.

According to Gerry Bryant, managing director of Countapulse Controls, sole southern African agent for EGE's full range of flow sensors and controllers, the innovative screw-in adapter on the EGE thermodynamic flow sensor allows for universal use in a variety of applications.

The adapter is screwed into a T-piece or a welding sleeve and the probe is then secured in this adapter using a union nut. Users are reassured of the integrity of the connection, which is sealed up to 100 bar.

The EGE sensor, which includes an LED display for ease of use, can function in temperatures from between -20 to +80°C and is suitable for controlling the flow of fluids such as water, glycol mixtures and chemicals. Ingress protected to IP67 standards the design of the sensor, which features no moving parts, is focused on elimination of failure that would typically be caused by oxidised bearings, torn impellers or deflector deformation.

With a robust construction the EGE flow sensor is resistant to corrosion and is ideal for use in both liquids and air, as well as in hazardous environments.

"This is a welcome addition to the Countapulse Controls product line-up and complements the company's existing range of sensing solutions; all geared around reliability and longevity combined with uncompromising accuracy," says Bryant.

Countapulse Controls offers a comprehensive range of sensing, measurement, counting, switching, monitoring and positioning instrumentation, with customer support provided through a round-the-clock technical advisory service hotline.

The compact plug and play EGE SNS 450 thermodynamic flow sensor provides ease of flow monitoring with low maintenance benefits.

Centre Chairman with SAIEE President. From left: Zola Ntshangase (KZN Centre), Maanda Ramatumbu (Gauteng), Dr Ben Kotze (Central), André Hoffmann, Antony Falconer (Eastern Cape), Ludolph de Klerk (Mpumalanga) and Bruce Thomas (Western Cape).

*In the November issue of **watt**now, I mistakenly misspelled Antony Falconer's name. Herewith the placement again. Apologies Antony. Ed*

and local businesses, the Voltex team was able to put together the renovation plan and begin the project on the 24th of October. The contributing sponsors/donors/participants on this project: Tile Africa; JBN Power; JMC Lighting; Durban Domestic; KZN Switchboard; Dees Electrical; KGH Electrical; Harms Refrigeration; Mikes Electrical; PK Electrical; Billson Electrical; Cryril Nair; Powergen Electrical; Dafco Paints; and Silveray.

The total renovation took 5 weeks to complete and included everything from a new kitchen to new electrical boards, switches, painting, cupboards, storage, railings, security and flooring to aesthetics such as adding curtains, bedding, pathways and a highly essential vegetable patch. The newly renovated cottage, which is home for boys between the ages of 6 to 12, was handed over to Shehnaaz Gabru of the Lakehaven Children's Home on the 27th of November.

WATTSUP

Another robotic first in Africa for Urology

The Urology Hospital in Pretoria has successfully conducted Africa's first robotic-assisted removal of a cancerous bladder (cystectomy) and prostate (cysto-prostatectomy).

Dr Hugo van der Merwe, who performed the surgery, also used the robotic system to reconstruct a new bladder (neobladder) from the patient's bowel, after removing the cancerous bladder and prostate in what is normally a high morbid surgery

"Success using the robotic system has been excellent," said van der Merwe. *"The patient had aggressive bladder cancer and needed standard post-operative chemotherapy. The recovery is remarkable."*

The 36-year-old patient now has perfect bladder control, is fully potent and enjoys normal bodily functions without the burden of a colostomy bag.

Van der Merwe added: *"Standard surgical procedures are associated with very high morbidity (complication) rates. Even in the best medical centres in the world there is a 30% chance of secondary surgery within the first 30 days after operating as well as significant problem such as blood loss, pneumonia and embolism. The robotic system aids in significantly less morbidity and recovery time is much faster. We have not as yet had to take any patients back to theatre due to complications."*

Schneider Electric launches the 6th edition of Go Green in the City, its global student case challenge

Schneider Electric, the global specialist in energy management and automation, launched the 6th edition of Go Green in the City, its global business case challenge focusing on innovative energy solutions for smart cities.

From January 15th to April 15th, 2016, business and engineering bachelor, master or MBA students from all over the world are welcome to join the challenge. By teams of two, with at least one woman, they will submit a case study illustrating their ideas for innovative energy management solutions in cities for one of the five basic business challenge topics. In 2015, the student team from the Indian Institute of Technology Kharagpur won the challenge for its idea of an efficient energy management application. Over the last five years, energy management in smart cities has received increasing attention from students around the world. Attracting more than 12,800 registered participants from 168 countries with 57% of women during last year's edition, Go Green in the City aims to educate young generations and build awareness about the need for smart energy management for sustainable cities. In 2015, India, Indonesia and Korea have been particularly active and high represented among the total submissions.

The semi-finalist teams will have 2 months to work with a mentor from Schneider Electric to create a synopsis and a video presentation of their idea.

The 12 best teams will be announced on July 15th 2016, and will then be flown to Paris (France) from September 19th to 22nd 2016, to compete in the grand final. The winning team will travel the world, VIP-style, with Schneider Electric, visiting facilities, networking with employees and high-level management. They will also be offered jobs with Schneider Electric in their home countries.

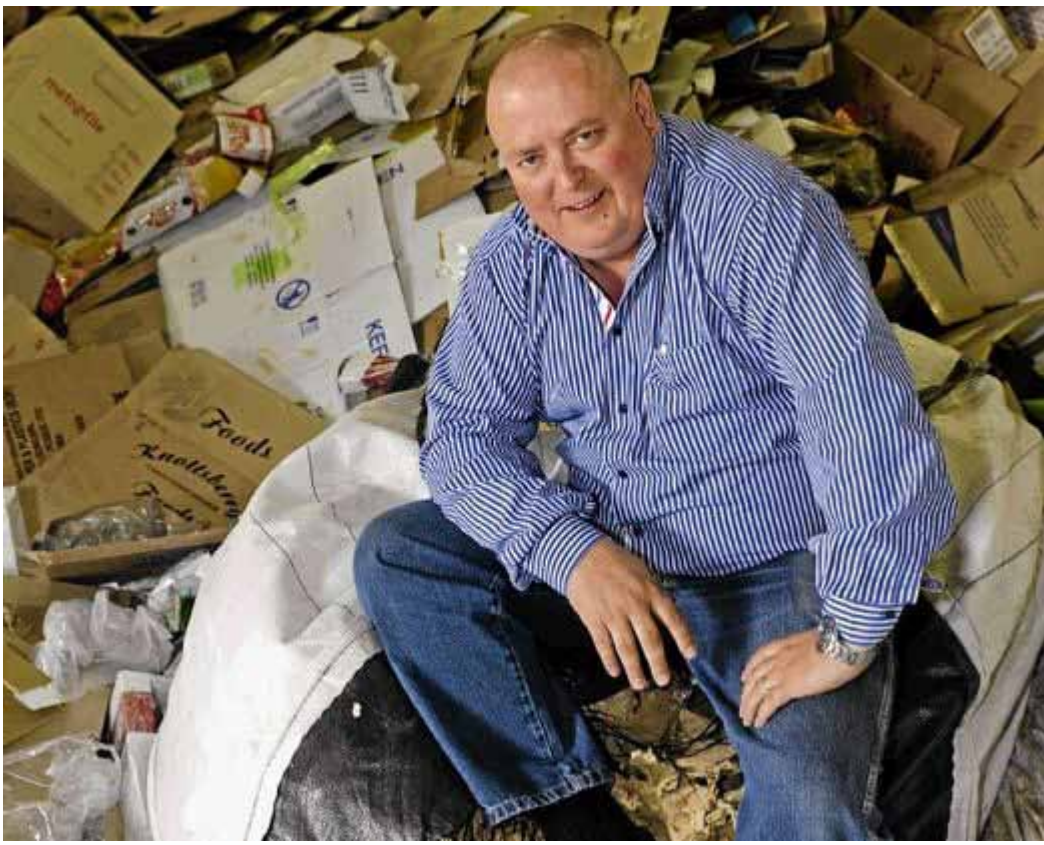
Interwaste launches first ever Refuse Derived Fuel Plant in South Africa

Interwaste – a leading local waste management business – announced the launch of South Africa's very first Refuse Derived Fuel (RDF) plant. The plant aims at reducing waste to landfill and pioneering general, industrial and municipal waste to alternative fuels, ensuring less reliance on South Africa's vital resources and resources that are carbon intensive. The current plant, which is the first of four lines, is expected to see a minimum of 12 000 tonnes of waste converted to alternative fuel, annually, for use in the South African manufacturing sector.

"In line with global best practice, Interwaste continually invests in innovative solutions that have the most environmentally sound waste management opportunity at its core, solutions that make us market leaders and place us in a favourable position within the competitive waste management environment. It is with this in mind, and with a strong focus on aiding our customers to reduce operational expenses, while acting responsibly towards the environment, that we commissioned the RDF plant and today, launch what is another market first since the business opened 25 years ago – which we are very proud of," says Allan Willcocks, CEO at Interwaste.

The plant, which was imported in 2015, is located in a facility built by Interwaste at the company's Germiston depot. It is currently producing a solid recovered fuel to European specified standards, which is equivalent to A Grade coal.

"Through the commissioning of such solutions, companies are able to lessen their reliance on fossil fuels, which have a high environmental impact including: acid mine drainage and reject coal for example and as such not only are businesses able to drastically improve their emissions profile but so too are they able to pay back their investment within a mere 5 years – where the fuel is substantially more economical," continues Willcocks.



Interwaste CEO, Allan Willcocks

Prior to the implementation of the plant locally, Interwaste underwent stringent environmental compliance procedures to ensure all due process was followed and that the facility would operate with a valid licence and the correct environmental authority approvals – which is critical in ensuring sound business practices.

The company has also pioneered the process in alternative fuels within the hazardous waste environment, ensuring that hazardous waste can be diverted from landfill, where such waste is not only expensive to landfill but toxic to the environment if not managed correctly.

"Locally the playing fields have changed, where the implementation of new and pending legislation is forcing companies to move to 21st century solutions, those solutions that offer real opportunity for environmental preservation. As such, from an Interwaste perspective, the provision of these fuels has not only opened up in excess of 100 jobs within the sector, but has created a very solid platform from which to protect the environment at large and of course, is a critical constitutional imperative in line with changing legislation," states Willcocks.

"However, we are not in this alone, it is up to corporate South Africa to understand the benefits of such solutions to their bottom line, and the environment, in order for us to make the change we want to see. We are positive about the impact of such market innovation and look forward to very exciting times with regards to RDF," concludes Willcocks.

2016 SMART GRID CONFERENCE FEEDBACK

Supercalifragilistic Smart Grid Inspiration!

The 2016 Smart Grid Conference was attended by approximately 300 delegates from all over South Africa, inter-Africa, and overseas.

BY | DEREK WOODBURN | PR. ENG | FSAIEE AND MINX AVRABOS

After months of planning and organizing, the day finally arrived for the 2016 SAIEE Smart Grid Conference. It took place at the Eskom Learning Academy in Midrand. Ian McKehnie's (Programme Director) warm welcome, George Debbo, Chairman of the SAIEE Organising Committee, stated that smart grids are an alternative to the "dumb power grids" South Africans have become accustomed to. He noted how important it was for smart sensing devices at the perimeter of power grids to be able to analyse and balance capacity with demand.

The first Keynote Speaker, Professor Massoud Amin (described as the Father of the Smart Grid), from the University of Minnesota, addressed the delegates and presented his paper "How to save ageing assets: Applying limited resources to critical infrastructure".

He told the story of the American infrastructure, started in 1882, which has now built up a staggering multi-billion Dollar maintenance backlog in the United States. Enormous damage is done to American wooden transmission poles by the ferocious storms that lash the US every year.

The danger from damaged lines, and the difficulty, especially under adverse weather conditions, in locating these full, or "incomplete" failures, can be difficult and time consuming. However, when smart grids are in place, these fault locations can usually be rapidly identified through smart sensors, systems and fibre-optic communications.

Strenghtening the ageing network through replacing (40 to 60 years old) wooden poles with fibre-reinforced concrete poles is extending the life of new transmission systems.

The built-in intelligence of the meters that interface with all of the distribution systems' components, (e.g. transformers; switchgear, transmission lines, etc.) is making multi-phase integration approaches possible. The age of the distribution equipment contributes towards its failure rate, as does the extent to which it is abused and overheated. Take this into account when built-in smart sensors can

From left: André Hoffmann, SAIEE President; Prof Massoud Amin, University of Minnesota, US; George Debbo, Chairman, Organising Committee; Prof Qing-Guo Wang, University of Johannesburg; Mr Lee Stogner, President Vincula Group; and Stan Bridgens, CEO SAIEE.

provide early warning of impending failures. The costs of pre-emptive replacement of failing equipment is far lower than that of catastrophic failure. Smart grids are data driven. Decision makers must have the correct vision, and be able to execute it.

Mr Brian Molefe, Group Chief Executive of Eskom Holdings officially opened the Smart Grid Conference, and in his speech he said: "*...our own systems will be the bedrock of how we provide leadership and a much-needed shift for environmental and socio-economic sustainability.*"

He added "*With the right innovation, knowledge, and skills, the engineering fraternity will use smart grids to re-energise an ageing system to bring about growth and socio-economic development for the consumer of the future.*"

The contributors opened wide the vista of understanding for the participants. The visionary approach rocketed the attendees into the 21st Century. This covered the extent of the work already done on Smart Grids for Power Distribution, Smart Communications, Smart Services, Smart Buildings, Smart Water and Smart Cities.

The visionary presenters showed the inspiring work already being done in the United States, Europe, India and China, as well as in South Africa. This includes the enormous problem of managing South Africa's, and the world's, ageing infrastructure assets, together with the vast maintenance deficit that exists.

Singaporean Professor Wang of the University of Johannesburg spoke of how Singapore, located at the Southern tip of Malaysia, has a population of

SmartGrid 2016 Feedback

continues from page 17

From left: Celeste Pretorius, Minx Avrabos, Joanne Griffin and Gerda Geyer.

Head Office staff helping out with registration.

Brian Molefe, Group CEO, Eskom Holdings officially opened the conference.

5 million people. Because of its location close to the equator, 50% of its standing electrical load is in air conditioning. By incorporating and expanding smart grids, as well as more efficient systems, they are working towards a reduction of between 10 and 20% in power consumption.

During the panel discussions the need for a holistic overview of the current situation is essential. How South Africa should manage its ageing generation, transmission and distribution infrastructure, as well as the required communication requirements and the volume of this data, was discussed at some length. The impact on society's intelligent services, and this would affect personal cyber security was another topic that was debated. Accommodating internal variations was one of the fundamental areas to be investigated. All attendees agreed that the ageing assets required a 360 degree view of the problem to be taken.

The CEO of the South African National Energy Development Institute (SANEDI), Mr Nassiep spoke on their analysis of Municipalities in South Africa, and how critical it was for sound management principles to be extensively practiced.

Mr Makwarela of Eskom presented a paper about working towards Standardisation of Advanced Infrastructure in South Africa. The fact that it is essential that all providers of power (city, metro and Eskom) cooperate with each other to extend supply to the rural areas was also covered.

One presentation covered an investigation into a typial SA rural setting that is located far from access to the national grid. It involved combining a diesel generator, photo-voltaic panels and a small pumped storage system (for pumping water up to storage, and generating down flow). The demand in the study was relatively small, but the storage analysis showed good efficiencies could be achieved over the limited times of use.

One of the keynote speakers, Mr Lee Stogner, President of the Vincula Group, USA gave a fascinating presentation on "Smart Grids and the Internet of Things".

Mr Verster explored the topic of "The Role of Smart Transformers within Microgrids". He related the vision of Thomas Edison and Nicola Tesla over a hundred and twenty years ago, and how we are fortunate today to be able to live their dream.

Jennifer Chinniah presented "Cyber Security: The Privacy Considerations for the Smart Grid". She discussed how the Smart Grid provided up to eight times more data than previously, and how it affected our personal travel habits. She also expanded on the safe framework of the "Protection of Personal Information (POPI) Act of 2013".

Dr Charlotte Higgins presented her insightful contribution on "A review of smart network solutions for South Africa".

Mr Shawn Papi discussed "Accelerated Environmental Stress Test Procedure for Smart Electricity Meters". The meters are expected to last between 10 and 15 years under adverse conditions. They have developed procedures to subject smart

meters to accelerated ageing. This shows up faulty design or manufacture within 2 months. He descruibed hpw Eskom has developed and installed approximately 4 million pre-paid meters. They are subjected to temperature variations of +55˚C to -15˚C, as well as high humidity, vibration (to simulate delivery trucks), drop tests, lightning surges, etc.

Mr Stan Xu of Huawei Technology (Silver Sponsor) discussed "Building a Better Connected Smart Grid". He explained how his company had a global commitment, effecting 3.5 billion in 70 countries.

The Conference was spread over three days, with dual track sessions presented in both the John Maree and Dr Ian McRae auditoriums. Participants were enthusiastic in their participation of the Conference, how it was in its organisation, and about the information they had received.

The delegates enjoyed a relaxing networking cocktail party at the end of Day 1, which had decision makers and students rubbing shoulders with our keynote speakers.

Delegates attending The Smart Camp 101 were hosted by Mike Barker. This 'bootcamp' was a SAIEE Smart Grid outreach program for students and young engineers to create awareness about the "what" and "how" of Smart Grids and to discover opportunities to ride this global technological wave. It was designed as a one day workshop to cover fundamental Smart Grid technologies.

The SAIEE will host the 2nd Smart Grid Conference in 2018, and this time, we can only go bigger and better. Watch this space.

Organising Committee - from left: George Debbo (Chairman), Gerda Geyer, Stan Bridgens, Minx Avrabos & Marius Mostert.

Mr Lee Stogner, President Vincula Group, USA.

Eskom & SAIEE Executive from left: Maanda Ramatumbu, André Hoffmann, Boitumelo Tlholakae, Ian McKehnie, George Debbo, Edwin Mabelane, Willie Majola, Prince Moyo, Stan Bridgens & Jacob Machinjike.

Feedback on the Smart Grid Bootcamp from left, Mike Barker & Lucky Mokalusi.

Industry to Maintain Transformers

Transformers have often been referred to as one of the most efficient pieces of equipment developed by mankind and, as this apparatus has limited moving parts, majority of individuals believe it to be maintenance free.

There could be nothing further from the truth, according to Andre Mans, COO of WEG Transformers Africa, who says getting optimum performance and a long functional life from this essential asset is contingent on having a comprehensive preventative maintenance and service strategy in place.

"Preventative maintenance of transformers is critical not only from an operational reliability perspective but also because a well-structured maintenance programme will significantly extend the life of the transformer. In most cases it is not inconceivable for a well-maintained transformer installation to have a lifetime that outstrips that of an average human," Mans says. *"This could between 40 to 50 years."*

CUSTOM SUPPORT PROGRAMMES

WEG Transformers Africa (WTA) offers a suite of support services for its transformers customer base and these include preventative maintenance programmes that can be structured to accommodate customer needs and/or budgets. Mans stresses that it is, however, most important for customers to do an initial assessment of the transformer installation as this will allow a base line to be verified and following any corrective action a customised support programme can be implemented to ensure the optimum reliability of the transformer.

During a preventative maintenance assessment, WTA's team of skilled technicians will rate the transformer according to the application in which it is being used. Following this, a needs-based maintenance strategy is implemented with the objective of reducing the probability of transformer failure.

"We are able to provide verifiable reporting on the condition of the transformer using oil sampling, analysis and thermal graphics surveys, all of which meets international quality standards reporting requirements and are accepted by most insurance," Mans says.

"Our maintenance strategies are customised for each installation to track the asset condition and enable verifiable reporting on performance degradation. Preventative maintenance can provide an early warning mechanism as it provides crucial information that could facilitate an early intervention with major servicing or even component replacement," Mans continues.

ON-SITE PREVENTATIVE MAINTENANCE

Transformer oil sampling is carried out by skilled individuals to ensure accuracy and reliability. The manner the sample is taken is critical to the result and sampling tins are only used once to avoid cross contamination.

When drawing the oil sample, the sampling technician will also do a visual external inspection of the transformer against a checklist as this will pick up any physical issues with the transformer. Evidence of leaks or a change in colour of the silica gel will be a clear indication that there is moisture ingress. The general condition will also give an indication of corrosion.

In addition to the visual assessment and oil sampling and analysis, the WTA team undertakes thermal graphic surveys to determine areas where excessive heat may be present in the transformer and other electrical equipment. All information is accurately documented to ensure it can be compared against new information from subsequent follow-up on-site condition monitoring inspections.

WTA OIL SAMPLING LABORATORY

One of most important differentiators for the WTA customer base is that the operation has a fully-fledged oil sampling laboratory at its facility in Heidelberg. According to Mans, it is considered by industry as the best privately run laboratory in the country.

Samples are brought back to this laboratory where state-of-the-art equipment and international best practice is used to analyse the oil. The oil sample is compared to a base line and this enables the technicians in the laboratory to identify potential problems which cause transformer failure.

The Karl Fischer titration procedure (moisture parts per million (PPM)) is used to determine the moisture content of the oil. High moisture will result in dielectric breakdown .

The oil is analysed to determine where Polychlorinated Biphenyl (PCB) is present because of the high risk factor associated with exposure to this substance and the potential risk should it catch fire. The PCB test is done to identify whether the oil contains PCB, and if so the amount.

Furanic analysis is also done and this determines the cellulous breakdown products in the oil and gives an indication of the life expectancy of the insulation in the transformer.

Other tests include kV or dielectric strength testing to determine the insulating properties and DGA dissolved gas analysis, which provides a clear indication of internal failure conditions. Acid levels are also checked against acceptable standards.

FOLLOW UP INTERVENTIONS

Following the comprehensive oil analysis, WTA's mobile field service teams are able to implement interventions to address identified issues. These interventions could include anything as basic as re-torqueing the transformer to replacing gaskets and cone rubbers right up to major on-site repairs including replacing offload tap changers.

Significantly, the WTA field service teams operate from fully equipped vehicles with all the necessary tooling as well as 4 500 litre per hour high vacuum purification unit. These skilled technicians are able to do the most basic physical inspection to full on-site repair work.

"We are one of few OEMs that can offer this level of support to industry and on-going training ensures that our team is kept abreast of technology as well as operational skills such as working at height, fire fighting and HV regulations," Mans says.

Other maintenance activities done on site deal primarily with the condition of the transformer and could entail purification and regeneration as well as vacuum treatment being done to eliminate entrapped air.

Oil samples are taken after all inventions to gauge the success of the intervention.

VERIFIABLE REPORTING

All work done by the WTA laboratory is documented and customers receive a before and an after report.

"This maintenance of an historical database is essential as it allows the accurate tracking of the condition of an individual transformer and it also allows identification and investigation of trends that may develop in individual transformers," Mans says.

"By having experienced OEM technicians do regular surveys on transformers to assess their operational health, it is possible to mitigate against any potential risk in terms of asset failure," Mans concludes. wn

Join the Engineering Revolution

Following the inaugural Civilution held in 2014, we are pleased to let you know that the time has come for the second Civilution!

This years' event is aimed at facilitating innovation and education for success in Africa's engineering industry. Civilution 2016 will be using the key themes of issues such as Procurement and Delivery, Professionalism, Skill Development, Competency & Capacity and will drive the way forward in introducing new solutions.

Join us in listening to an elite line-up of speakers such as Nazir Alli, Outgoing CEO of SANRAL, who will be at the Opening Keynote session discussing ways how engineers can attract viable and sustainable implementation of engineering and infrastructure delivery in South Africa.

We are all mindful that South Africa will need at least 30 000 qualified engineers and artisans by 2030 as envisaged in the National Development Plan. How will the Engineering institutions and Government develop partnerships to aid in the delivery of these figures? Civilution will be the platform to provide answers to this very question, as well as other pertinent issues facing the industry.

Manglin Pillay, CEO of SAICE says: *"Civilution encapsulates the tenets of a cause, and it defines an era during which engineers resolutely reinstate technical, intellectual and strategic leadership. It is an era of engineers in revolution. The engineers' revolution is firstly an introspective conversion, where we abandon pessimism and distrust, and regenerate ourselves to become a creative and intelligent part of the solution again, driven by the belief we held in our hearts when we first became engineers – that we can make a difference. Civilution 2016, accentuates the intellectual revolution and focusses on accountability from both the private sector as well as the public sector. As a team comprising of public and private sector players in service delivery, we are called upon to examine our efficiency at delivering, operating and maintaining infrastructure – are we delivering value for money, in a time, when capital, skills and leadership is scarce. This is what Civilution 2016 aims to address. Come and lend your voice to the struggle."*

As Pillay says; the forum is aimed at engineering professionals – and seeks to motivate engineers of all disciplines to conduct business differently. It calls upon engineers to become history makers in bringing about transformation, diversity, leadership and evolution in the built environment sector, while we improve the quality of life through efficient delivery of social and economic infrastructure.

The event will convene from 9-10 May 2016 at the Gallagher Estate in Midrand and promises to be an event you can't afford to miss!

HIGHLIGHTS:

- Two days of valuable conference and debate sessions;
- Exclusive Civilution Congress Pavillion Expo;
- High level speakers from government and private sectors;
- Extra value: Co-located with African Construction and Totally Concrete Expos: Hear about opportunities in Africa's burgeoning construction industry in the joint keynote session;
- Upgraded venue at Gallagher Convention Centre: Conveniently situated and allows easy access for attendees from South Africa and beyond;
- And much more!

Join us in May 2016 and be part of the Engineering Revolution! wn

For more information contact:
Adrienne.taylor@hypenica.com or visit
www.civilutioncongress.com

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ENGINEERING REVOLUTION

9-10 May 2016 - Congress
9-11 May 2016 - Exhibition

Gallagher Estate, Midrand

Civilution 2016 aims to deliver a congress which targets issues such as Procurement and Delivery, Professionalism, Skills Development, Competency & Capacity, Value for Money and will drive the way forward by introducing new solutions.

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SA at the forefront of solar power, battery technology advances

There was burgeoning interest in rooftop solar photovoltaic (PV) power solutions for domestic, commercial and industrial applications in South Africa in 2016 as consumers from all sectors of the economy showed their increasing determination to reduce their reliance on Eskom.

BY | JACK WARD | MD | POWERMODE

Concern over power reliability, possible load-shedding and looming electricity price hikes characterised the past year, persuading an increasing number of consumers to opt for solar power - nature's free alternative – which continues to be seen as an attractive, cost-effective solution, particularly when compared to noisy diesel- or petrol-powered generator alternatives.

Decisions to select solar power as the 'go-to' option were often supported by developments in solar technology in 2015 including the release of utility grid-connected, hybrid solar PV power systems capable of functioning as back-up rather than complementary power sources in the event of a power outage.

These systems can be operated in three modes: linked to the electricity grid (grid-tied); as grid-tied unit with battery backup (in a hybrid configuration); or as a stand-alone hybrid unit. In line with uninterruptible power supply (UPS) and other conventional solutions, switchover time from mains to batteries is a rapid 15 milliseconds.

Mirroring advances in solarPV technology came a breakthrough in system design and application when South Africa's Soltra Energy released an innovative solution to provide businesses with more effective energy returns from rooftop solar systems. Conventional wisdom maintains that solar PV panels should be orientated towards north in the southern hemisphere to allow for the most efficient power generation. The result, from a power production standpoint, is a 'bell curve' reflecting power increases throughout the day peaking at midday and gradually falling again to zero at sunset.

In mid-2015 an iterative evaluation process involving a grid-linked hybrid solar PV application for a Johannesburg-based company was undertaken in which various solar PV system configurations were tested. The outcome has proven that a convention-breaking east-west orientation of solar panels can often be more advantageous for a business application.

The motivation for the tests was an Eskom electrical power supply historically incapable of meeting the

business' full demand. A complementary challenge was also met. This was to reduce the aggregate electricity cost for the facility.

South Africa has also seen a major step up in battery storage technology in 2015. The prevalence of routine load shedding and power outages has exposed one of the Achilles heels of standby power devices. This is the shortened lifespan of batteries when subjected to full depletion on a regular basis. This includes specialised, sealed, deep cycle VRLA batteries.

These batteries are not designed to cope with load-shedding. They're intended to backup sensitive equipment such as computers for brief periods during which petrol/diesel generators take over or operators execute a safe power-down.

A period of load shedding, usually ranging from two to four hours, can fully deplete a battery pack. If repeated often enough, the batteries' life can be reduced to around six months or less. Last year the market witnessed the launch of the SA-designed 'long-run' battery pack geared to obviate this problem. Brought to market by Powermode (which offers a market-first, three-year guarantee with its offering) the Q-on LR battery system is based on the principle that the key to battery longevity lies in a thorough understanding of the status of batteries in terms of their duty cycles and load factors.

In the case of this pioneering long-run battery, the knowledge is facilitated by 'smart' technology built into the battery pack. This includes a computerised battery balancing harness that automatically reports - via a 'cloud-based' portal - on a range of parameters associated with individual batteries in the pack.

Perhaps one of SA's more memorable advances in the power provisioning field in 2015 was bringing a locally-designed 'power wall' lithium-ion battery pack solution to market ahead of US manufacturer Tesla.

Like its American counterpart, the SA-manufactured Soltra Energy Wall is designed to store excess energy, whether it is derived from the Eskom grid, from solar panels or a combination of both as found in increasingly common hybrid systems.

The space-saving unit represents a leap forward in battery storage and is expected to boost the acceptance of rooftop solarPV-plus-battery solutions in 2016 and beyond, giving SA consumers greater control over their energy usage.

Efficient battery storage could quickly become one of the biggest game-changers in the South African energy landscape, which will continue to be characterised by a mismatch between demand and supply. It's a technology whose time has finally arrived. wn

Commitment to High-End Technology

Staying on top of the ever changing demands of industry coupled with the pending changes to South African legislation requires a dynamic approach when it comes to Pedestrian Detection Systems (PDS). One of the biggest challenges is to get customers to understand the different technologies and what each can do, and then to get them to embrace these technologies.

Anton Lourens, Managing Director of Booyco Electronics, says that often the barrier to embracing technology is cost related and this cannot always be overcome as high-end technology is expensive. *"High-end technology development takes time and verification testing outside of laboratory conditions is part of this process,"* Lourens explains. *"This type of development requires a close working relationship with customers as well as realistic expectations from all."*

Lourens is emphatic when he says that South African companies have the ability to develop and manufacture high-end technology. *"We have exceptionally capable developers and engineers and you just need to look across industry sectors to see the depth of knowledge and intellect that resides in this country; it spans all the way from physical mechanical engineering to software and specialist mobile applications.*

"South Africans are known to be hard workers. We don't give up easily and it is this very persistence that has produced best-in-class products. Never mind thinking out the box; we generally don't believe there is a box," he says.

As an example, Lourens points to the Booyco Controller Interface which is essentially a processing gateway through which all sensing technologies and informational data is channelled to create the requisite artificial intelligence which is fed to the control systems of the various TMM trackless mobile machinery. *"Although our use of the latest and high-end technology may be viewed as being ahead of the pack, we believe this will form the base necessity in the future,"* he says.

Significantly, Booyco Electronics has been at the forefront of the PDS technology development since the company was established in 2006. From

the first basic collision warning system to the Booyco Electronics PDS solution of today, the product has gone through three technology improvements. *"It is this embracing of newly available technology that has allowed Booyco Electronics to remain best-in-class,"* he says.

Industry demands have also changed over this period and it is through the application of the available appropriate technologies that the Booyco Electronics PDS system complies with current South African legislation.

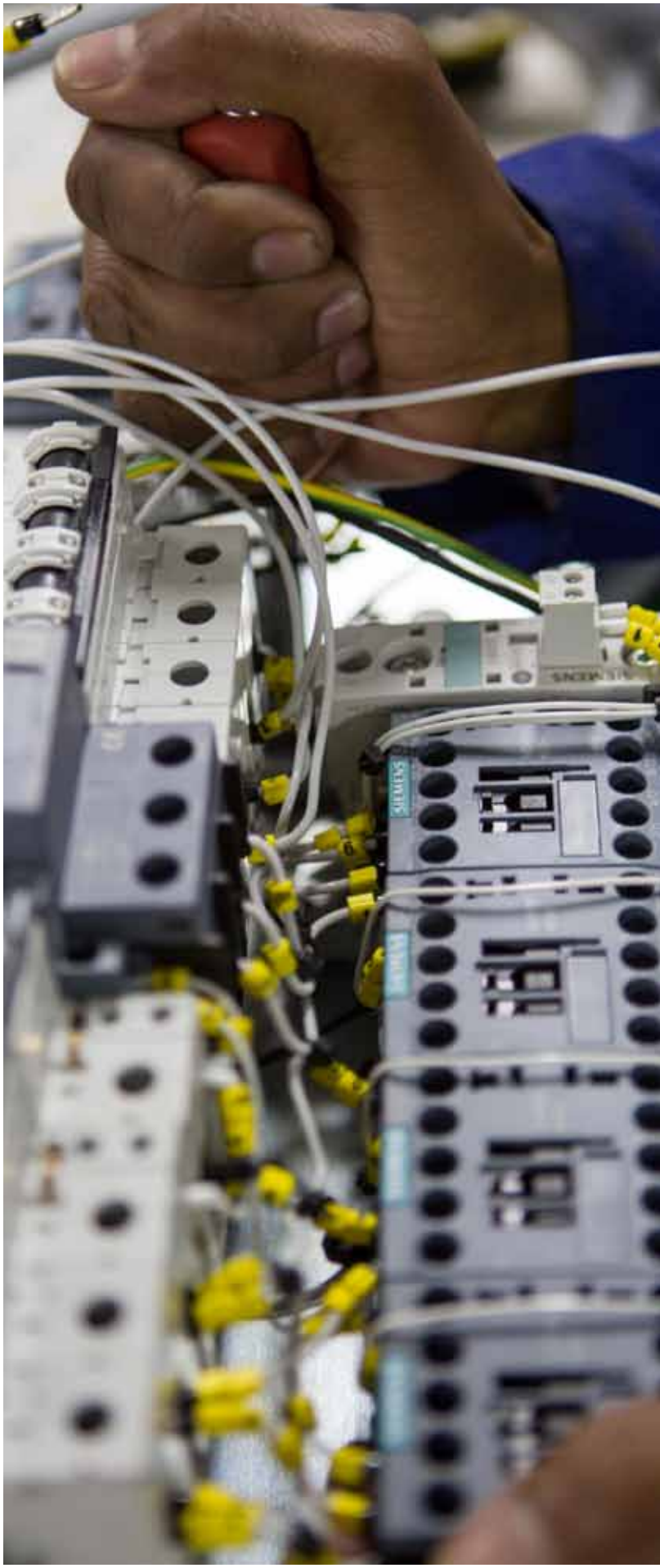
The legislation mandating the use of PDS systems came into being in South Africa in 2015, and Lourens says there are varying levels of involvement in the South African mining market when it comes to the deployment of high-end technology for PDS. He explains that where the development of PDS does not form part of a TMM organisation's global strategy, that company is less likely to develop systems that will comply specifically and only with South African legislation.

Booyco Electronics' fully integrated PDS represents the latest generation of this technology and offers a supply of information, which allows the safety intervention capability with a data hub that enables integration with TMM OEM's underground vehicles and equipment. Each PDS is deployed based on application specific risk assessments ensuring that it is fit-for-purpose, and according to Lourens this same PDS technology's deployment could vary between different types of vehicles on a single site.

Typically, the Booyco Electronics PDS incorporates VLF technology for pedestrian detection either on surface or underground together with GPS technology for vehicle detection on surface. It delivers specific warning, controlled slow-down and stopping zone alerts around a vehicle when detecting pedestrians or other vehicles. This is unique in that it is able to achieve zone shaping and create narrow band zones in close proximity on the side of the vehicles.

In the event of an emergency, an "emergency call" signal transmitted via the miners' personal communication tags can bring all vehicles in the area to an immediate stop if installed.

The PDS is manufactured with full self-diagnostics, and is visual and voice display activated in the case of a PDS warning or a system failure. It incorporates various downloading options for recorded data including wireless when at an access point. It is supplied complete with testing equipment for both the surface and underground areas to ensure maximum functionality. The system is also IS-compliant meeting the safety requirements of fiery mines. wn



IN MEMORIAM

Charles Farrel Landy

1945-2015

CHARLES F. LANDY, born on March 16, 1945 in Durban, South Africa, died on December 31, 2015. Beloved husband of Lorraine Landy, father and father-in-law of Shana Gordon and Ronelle Landy; loving grandfather of Eli, Dovi, Talya, Naftali, Temima, Yisroel and Aliza Gordon and brother of Sasha Landy.

BY | STAN BRIDGENS | PR. ENG | FSAIEE

Charles Landy joined the SAIEE as a student member on 7 August 1947, became a Graduate Member in 1967, a fully fledged member in 1972 and a Fellow, the highest grade of SAIEE membership, in 1994. Charles was a loyal member to the SAIEE for a total of 68 years and 4 months.

His applications for membership and regrading were supported by Wits University doyens such as Prof Bozzoli, Prof Cormack, Prof Reynders and Prof Hanrahan amongst others. A rich heritage of academic talent that augured well for Charles Landy to become part of this cohort fountain of engineering educators that has served South Africa over so many years.

While at Wits, Charles obtained his BSc(Eng), MSc(Eng) and PhD degrees from the University of the Witwatersrand in 1966 and 1976 respectively. He has authored and co-authored well over 100 publications in the field of Machines and Drives; and he was involved in a research program to develop linear synchronous machine systems for vertical conveying in deep-level mining operations.

Charles was the Mondi Professor of Machines and Drives, and became the Head (of what was then) the Department of Electrical Engineering in January 1995 - December 2000. Thereafter he agreed to act as the first Executive Dean of the newly formed Faculty of Engineering and the Built Environment, until his move to the USA.

At Wits throughout the profession, Charles was highly regarded for his leadership, his ability to mentor young engineers, and his sharp intellect – the ability to immediately assess a situation and to begin to work towards solutions. He was highly respected by his staff and students, and many consider him to have been their most valuable mentor in their own professional development.

When Charles decided to relocate to the USA circa 2008 he retained his SAIEE membership and his loyalty to our noble Institution. He demonstrated his ongoing interest in the affairs of the SAIEE by initiating the establishment of the Rotating Machines Interest Group, of which he was an avid member for many years and served for a while as Vice Chair.

Charles also served on the Professional Advisory Committee of the Engineering Council of South Africa where he was instrumental in ensuring that Candidates applying for professional registration were given due credit for their academic work. wn

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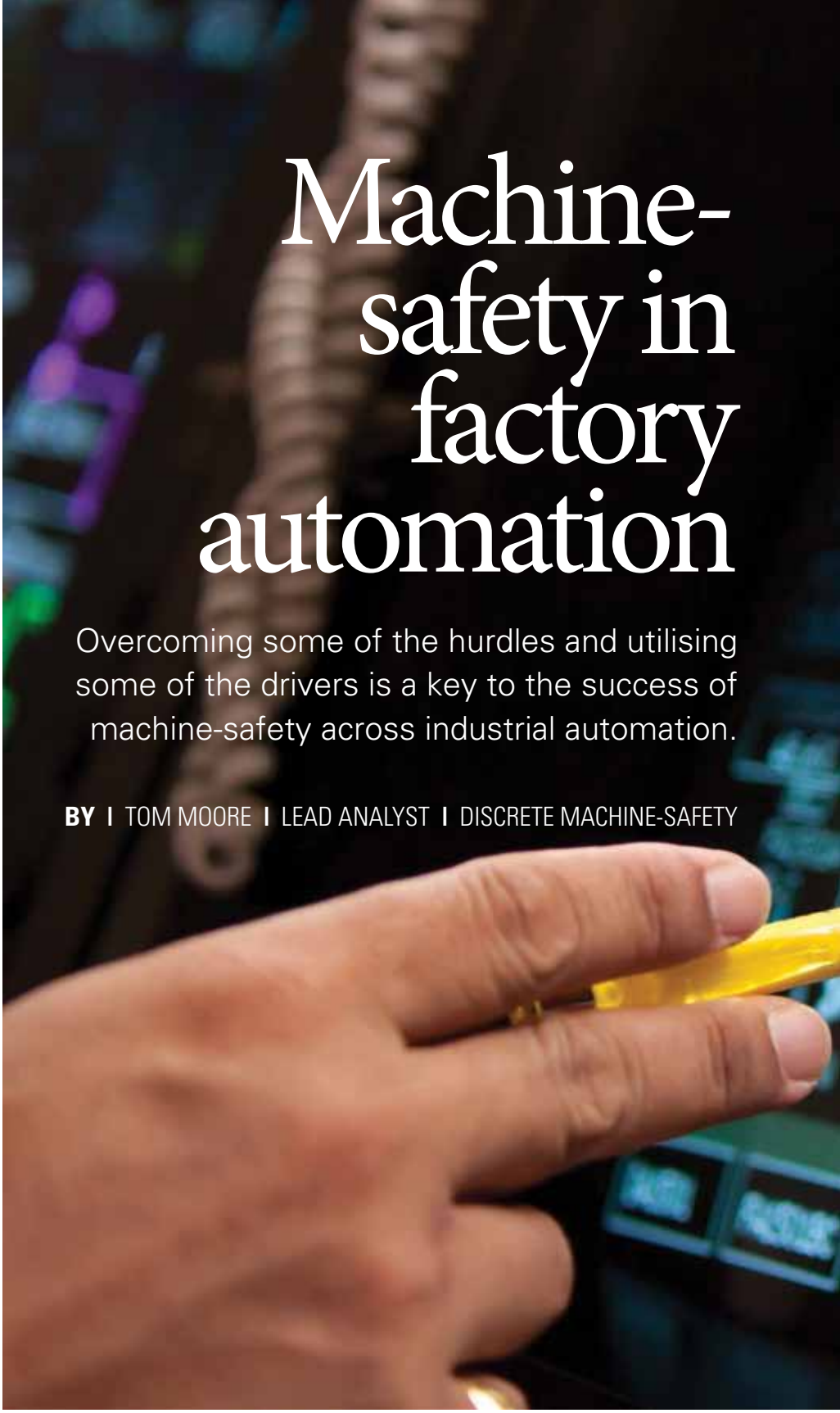
Machine-safety in factory automation

Overcoming some of the hurdles and utilising some of the drivers is a key to the success of machine-safety across industrial automation.

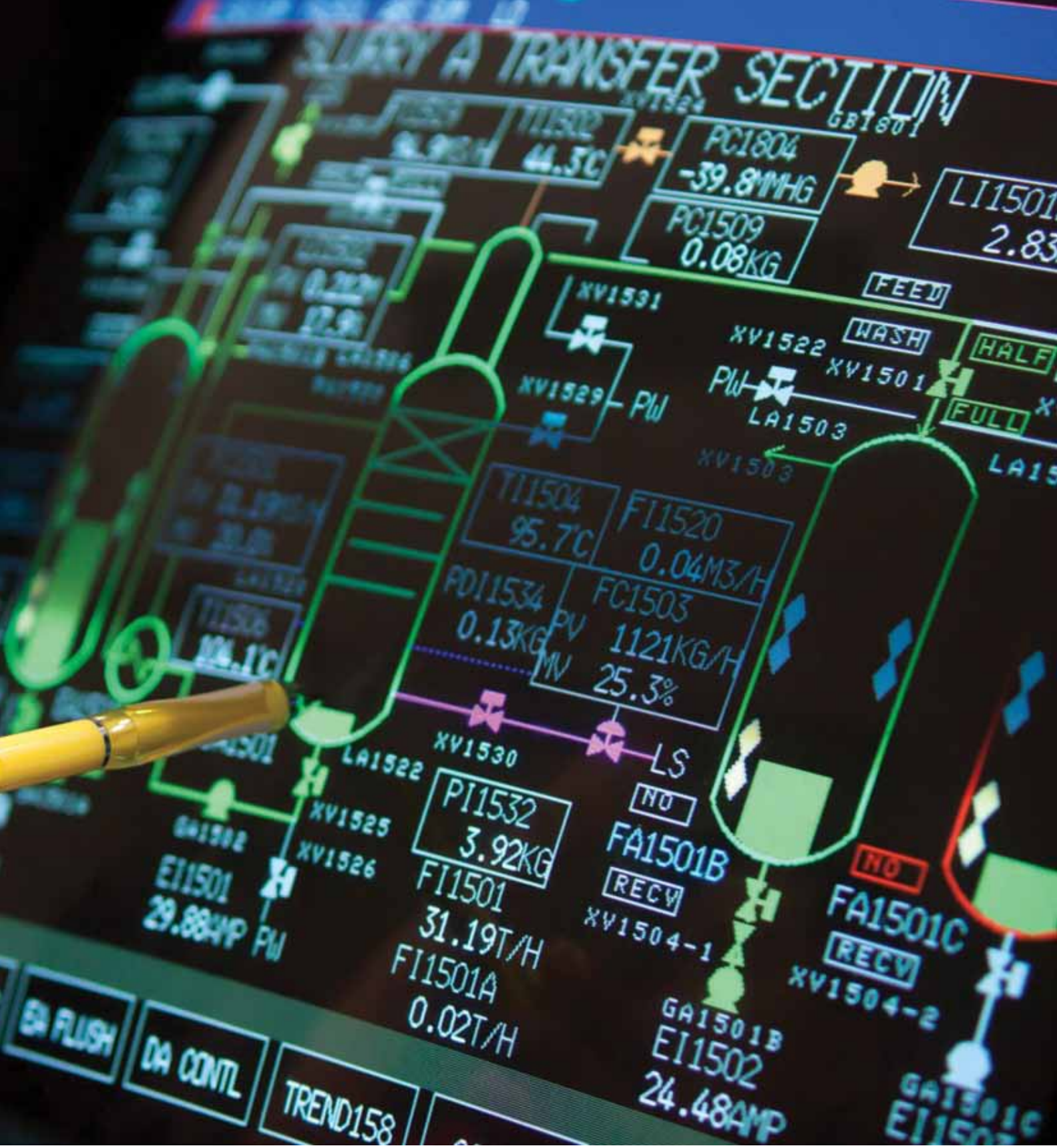
BY | TOM MOORE | LEAD ANALYST | DISCRETE MACHINE-SAFETY



There are many factors which could affect the overall adoption of safety in factory automation, they include:

MACHINE-SAFETY IN TODAY'S FACTORIES

Machine-safety has evolved in recent years. The idea that safety components and systems are only installed to appease the minimum requirements set out by law has lessened. Today the companies have realised that safety is also linked to



performance and to the image of a company. Unsafe environments can be damaging to a company's reputation, particularly in Europe and the Americas. This, and the potential performance gains, has put safety at the forefront of end user and OEM considerations; more are considering safety as a core component of a modern factory.

SAFETY FOR PERFORMANCE

Minimum levels of safety to meet the guidelines set out by law and regulation often do little to improve a machine's performance. However, additional safety can lead to gains in performance, which is a key focus for modern factories working in an incredibly competitive environment. Modern factories have the capability for

Machine Safety

continues from page 29

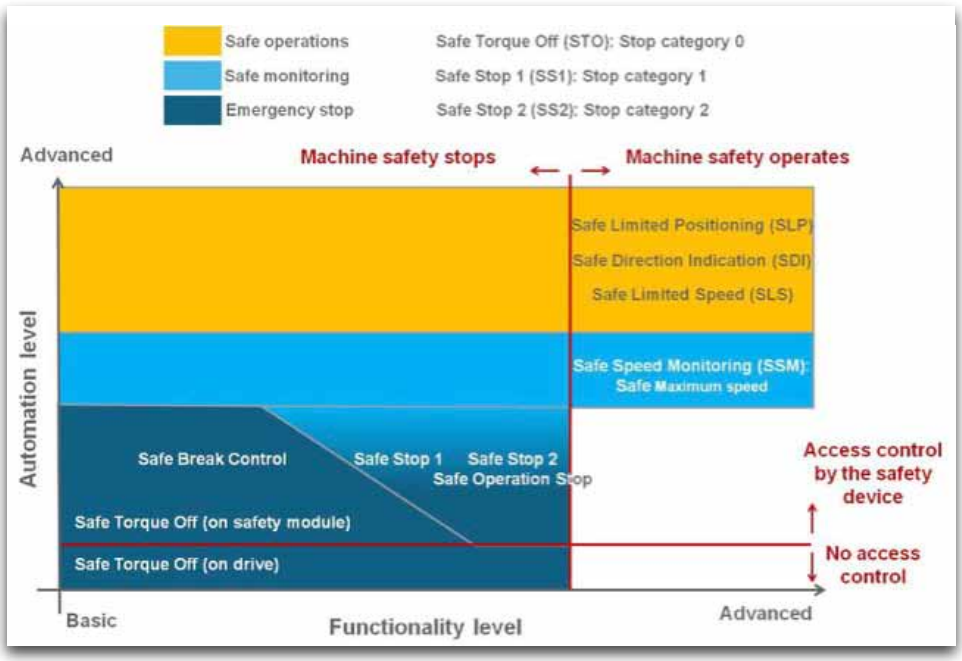
high-speed throughput, which means any downtime can be very costly. Safety overrides production; a simple safety stop can bring a production line to a halt for a considerable length of time while the problem is identified and the line reset.

Modern safety systems enable much more capable production lines, which may be able to continue production at a reduced rate even if a machine is being adjusted or materials loaded. Systems that go beyond a simple E-stop can now reduce motor speed, and in the future, torque; stopping or slowing production lines which are monitored by safety controllers or PLCs in place of simpler safety relays.

PERFORMANCE METRICS AS PART OF SAFETY

Safety system functionality is crucial for a facility because it means a problem can be quickly and easily identified. Using modern controllers with fast, reliable, and safe networks means specific events can be pinpointed to exact components, buttons and doors, and the reason identified through on-board diagnostics. Visual aids can also be used, with light beacons and strips showing physical location of the stop. Potentially, there is also the opportunity to use mobile devices, for example, smartphones more. These devices can help customers to reduce the downtime by using positioning in relation to the stop to minimise travel time, as well as propose solutions to the stop. This can be hugely beneficial because it means that if a shutdown has occurred unnecessarily, a line can be restarted quickly.

There is also the potential for a line to continue running, depending on the machine, even if a door or gate is opened and an interlock switch triggered. The motor and its drive can switch to an advanced safety level and continue running at reduced speed until the door is reset, while monitoring the situation in case an immediate stop is required. This ability to monitor and control a situation means that considerable downtime can be avoided.



Performance metrics can add up to considerable gains for a factory. If there is less downtime, then there is greater production time and more product throughput. Many factories are using performance metrics to not only measure production, but also stoppages; this can be greatly beneficial as a way to outperform the competition. The onset of solutions, rather than components, means this is becoming common.

SOLUTIONS, COMPONENTS AND INTEGRATION

Safety components, for example, E-stops, relays, and interlock switches are an integral part of safety and are often implemented separate from the machinery rather than as an embedded solution. Today, this approach is by far the most common and is often viewed as the best way to implement safety because of its non-software approach, reducing the potential for errors. It also reduces the fear that the system may restrict the machine's performance and damage the machinery. In developing regions such as India, safety is not valued as highly. It is often the case that safety networks are separate for fear that the control network may be slowed by a safety stop.

Although using safety components separately often works in very small/basic applications with 1–3 functions, it does have limited functionality and often makes recovering from stops more difficult and time consuming because of limited diagnostics. It can increase downtime whilst the safety system or device that has caused the stop is identified. Embedded safety solutions mean that the level of information that can be gathered is increased. They also offer greater capabilities, including higher intelligence and more functionality. Safety

components can often be embedded into machinery during the build to maximise the efficiency of the design and to improve effectiveness. This has many benefits; the most important are related to performance. When safety is integrated into the machine it is possible to track stops more quickly; utilising the latest networks means that a machine can be restarted quickly.

The market for individual components was still very large in 2014. A large number of users prefer a separate architecture for their safety systems as they believe that it will be less complex to install and less likely to affect machine performance. Indeed, latest IHS figures suggest the market for both basic and advanced components is growing well; the trend to higher-performance components is particularly prominent in developed regions.

FIGURE COMMENTS

The safety relay market is considerable, and remains larger than the controller market. The market for controllers is growing at a faster rate than relays. There is an ongoing trend to adopt higher-performance safety devices, which is partially driven by reduced cost and by the need for diagnostics and reduced safety distances, which increases performance. A single safety controller can easily do the tasks of ten or more relays, which is beneficial in cost and space, as well as direct sensor input. For those looking for more complex safety devices than relays, without the need of a safety PLC, there is now the option of configurable safety modules, which offer a solid middle ground. Although devices and their implementation are becoming more complex, users are still keen to simply monitor and adjust/control safety. Safety drives now make up a considerable portion of the safety component market; many are simple devices implementing safe torque off (STO) only. Drives incorporating higher levels of safety can continue operating while monitoring safety (highlighted in the diagram on Page 3).

PRODUCTS	MILLIONS $	CAGR (2014-2017)
E-stops	193.3	3.0%
Interlock switches	403.6	5.9%
Safety relays	408.0	4.4%
Configurable safety modules	203.9	6.7%
Safety controllers	327.1	7.6%
Safety drives	1,462.3	6.8%
TOTAL	**2,794.3**	

Figures (Market-size estimates for components in 2014)

Integration: Convergence of safety and control

As well as factors contributing to performance and the implementation of solutions there is also a convergence of safety and control.

As well as the possibility to embed safety, it is now possible to replace traditional relays or modules with embedded safety controllers that provide advanced diagnostics for the safety systems to manage control of the entire machine. This is not surprising, because of the dawn of high-end safety-based controllers, more complex applications, and increased technological capability.

Embedded safety provides a level of integration, while also providing adequate separation between the safety and automation lines. This reduces the reluctant of users, who have for many years rejected to integrate the safety and non-safety automation systems. This is due to a fear that their machines will be affected by the safety automation system.

Vendors of safety equipment re working hard to change this viewpoint because embedded safety can offer great benefits in performance.

It is likely that as safety relays are replaced with controllers, this will become a more apparent trend and users will become more accepting of the technology and integration into machinery.

Safe networking

Networking is an important topic and is becoming more prevalent in the minds of end users and OEMs. There are a number of networking technologies available that carry safety branding. Most are based on existing industrial Ethernet and fieldbus protocols.

Initially, there was concern that some standard Ethernet variants were not intrinsically safe. Most of these concerns

Machine Safety

continues from page 31

have now been dealt with and Ethernet variants are now equally, if not more, capable than older fieldbus equivalents.

Of major concern to a number of end users is whether newer, safety-based networking technologies will easily integrate with existing networks. Often the case is yes, but still users are often cautious and decide not to integrate the network. This can mean that efficiencies of the network and safety devices cannot be realised because communication is handled separately.

STANDARDS

The EU and American standards covering today's machine builders, end users and OEMs are perhaps the most daunting part of implementing safety. Legislation has existed in one form or another for many years, but has become more complex with time.

It is often the case that local standards will refer to each other, so to have a piece of machinery fully covered by the different directives can be a difficult task. It often falls to the industrial automation vendors to provide the information that a user needs to pass safety standards. Vendors now dedicate much resource to ensuring that customers' equipment is up- to-date. This is especially arduous when standards are so frequently updated, regionally specific, and complex.

An update of the EU safety standard is being produced which should simplify the process. This standard will be ISO/IEC 17305. The intention of this is to combine and streamline existing standards. It is projected that the new standard will be in place before 2020.

Standards elsewhere in the world are much more fluid and in some areas don't exist at all. The ideal situation would be a single worldwide standard, but this is unlikely to happen soon, if at all. This means that machine builders often have to comply with multiple safety standards. An advantage to European machine builders is that the EU standards are some of the strictest so it is often easier to adapt machinery to other regional requirements. Upcoming Chinese legislation (when it is finalised) will be very similar to EU standards, which again, will be a major advantage for European machine builders selling to China.

MOBILE DEVICES AND MACHINE-SAFETY

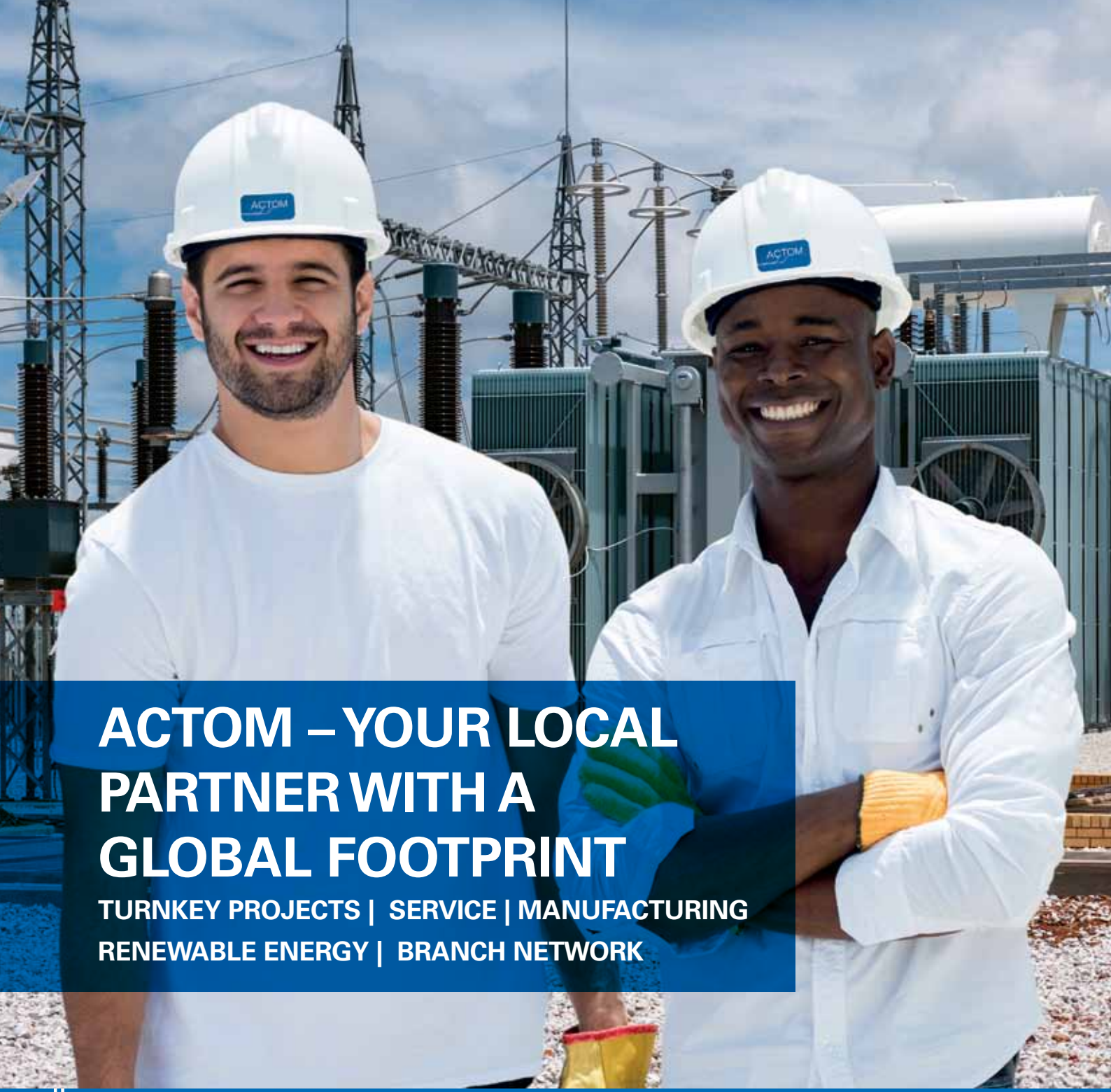
Mobile devices in industrial automation are a relatively new trend but their potential impact is widespread. Wireless mobile devices have the advantage of being intrinsically safe; if the signal drops, the safety stop is activated. They are often fitted with their own E-stop.

Some products already combine alert and control functions and are SIL3 certified. These devices offer great gains in flexibility and safety for operators. Signal reliability, a common concern, is mostly unfounded if correct assessments are conducted prior to installation. Perhaps the greatest risk for mobile devices is an operator physically removing a wireless controller from the factory environment.

THE FUTURE OF MACHINE-SAFETY IN FACTORY AUTOMATION

The machine-safety market is still a relatively young and fast-moving market when compared with factory automation in general. Implementing the latest safety solutions can help to boost not only a machine's performance (from reduced downtime), but also a company's image by avoiding damaging press. Only in recent years have end users and OEMs begun to understand this and utilise safety not just to be safe, but to improve performance. The latest in high-end networked equipment, including on-board diagnostics and remote HMI capabilities to find and quickly resolve machine stops, means so much more can be done than previously.

There is a knowledge gap with users in some cases, so industrial automation component vendors are contributing much resource to help users understand all the options, including the standards, and many users now rely on this to implement the latest standards and technologies. If vendors can work to simplify these standards (particularly in the European Union), as well as develop more intelligent technology, this will benefit them and safety users; they can implement safety more widely, based on sound knowledge. wn



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Avoiding Electrical Hazards at Work

Every year, workers are injured or killed by electrical circuits they thought were safely turned off. Simply shutting off the power is not enough as hazardous conditions can still exist. It is imperative that the operator always tests the installation before touching it.

BY | SIKHUMBUZO NGWENYA

Electrical hazards on the job can be avoided if skilled employees are trained in electrical safety procedures and that they understand and follow safety precautions. Those not trained to recognize and avoid electrical hazards, or not operating under the supervision of those qualified in electrical safety procedures, should avoid contact with electrical systems and equipment.

An electrical arc flash originates from a breakdown in the insulation medium creating conductive plasma. Heat propagation from the plasma is predominantly infrared radiation with temperatures exceeding 20 000°C. Workers operating on electrical equipment posing an electrical arc flash hazard should be protected against such high temperatures.

In the event of an electric arc, flash fire, or exposure to energized equipment, a worker can find himself completely unprotected against forces that cause severe or fatal injuries. Everyday work clothes can ignite and will continue to burn even after the source of ignition has been removed.

Arc rated Personal Protective equipment (PPE) is clothing and equipment worn by

employees, contractors or visitors to protect or shield their bodies from workplace hazards. Arc rated PPE is a major factor in differentiating between an electrical event you walk away from and one that requires months of painful healing.

Arc rated PPE comes in many different forms, including hard hats, gloves, goggles, safety shoes, flame-resistant jackets and pants, safety glasses, face shields, balaclavas and more.

Electrical power systems operate at various voltage levels from 415 V to 765 kV while electrical equipment can undergo abnormalities in its life time due to various reasons. The most common cause of an electrical surge is heavy electrical equipment being turned off. Under these conditions, computer systems and other high tech equipment can experience equipment shut down, errors or memory loss.

It is necessary to avoid these abnormal operating conditions for safety of the equipment. Even more important is safety of the human personnel which may be endangered due to exposure to live parts under fault or abnormal operating conditions. A small 50 mA current is sufficient to cause a fatality! Whenever human security is sacrificed or there exists possibility of equipment damage, it is necessary to isolate and de-energize the equipment. Each piece of electrical equipment has to be monitored to protect it and provide human safety under abnormal operating conditions. This job is assigned to electrical protection systems. It encompasses apparatus and system protection. wn

Article courtesy of Surgetek.

Stay Safe with the Double Key Panel lock!

The "double key lock" was designed to positively ensure that "no entry" to dangerous areas remains and stays "no entry". Until the area to be entered into is made safe with the implementation of this product.

DEFINITION

door

noun

a hinged, sliding, or revolving barrier at the entrance to a building, room, or vehicle, or in the framework of a cupboard.

With the increasing numbers of cable theft and work place theft, the 'double key panel lock' was developed to safeguard any door. It consists of 2 components,

1. The lock body with its own dedicated key; and
2. A "door key" unit.

The double key panel lock is fitted to the 'panel' frame and the 'door key' unit is fitted to the door. A main switch/isolator unit is a (separate) unit altogether – see picture.Under normal conditions the panel door will be closed and the room/substation/panel is safe while live/on. A panel door fitted with a double key lock can only be opened with its dedicated coded key which is trapped into a separate isolator/main switch during normal operation.

The procedure for working inside a panel fitted with this product are as follows: removed trapped key from separate isolator/main switch (switch off) and put it into the double key lock of the panel to be opened. The panel is safe to enter. Turn the key clockwise which will allow you to open the door and at the same time the key will be trapped while the door is open. This key can not be removed while the door is open.

Repairs can then be made to the 'safe' panel. After repairs are done the above procedure is reversed. The panel door must be closed before the key can be released. Once the key is released it must be placed back in to the

main switch/isolator of the panel and turned to switch on. Operation is back to normal and technician is safe.

The panel door with its fitted 'door key unit' becomes a key on its own, which will only release the key when the door is closed. The nature of its design ensures that this product can not be illegally bypassed. wn

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Renewable Energy

The world wide use of renewable sources of power has been increasing at an unprecedented rate. This has largely been motivated by the need to reduce the dependency on fossil fuels and the need to reduce CO_2 emission.

BY | DUDLEY BASSON

Several forms of renewable power are available, depending on local conditions. These include: hydroelectric, wind turbines, photovoltaic, concentrated solar, biomass, biogas, landfill gas, geothermal, wave power and tidal power. It is also possible to generate power from temperature and salinity gradients in sea water. Seaweed (macro algae) is another potentially vast source of bio-fuel. Some seaweeds have very high sugar content which can be used to produce ethanol.

In South Africa the three major sources of renewable power are from wind turbines, photovoltaic and concentrated solar, which are able to utilise onshore winds and the exceptional availability of solar power. Offshore wind farms have not been considered for South Africa. The

HYDROELECTRIC DAM	SITE	MW	OPERATIONAL
Three Gorges Dam	China	22.5 GW	2012
Itaipu Dam	Brazil/Paraguay	14 GW	1981-1984
Xiluodu Dam	China	13,86 GW	2013 - 2014
Guri Dam	Venezuela	10,2 GW	1978

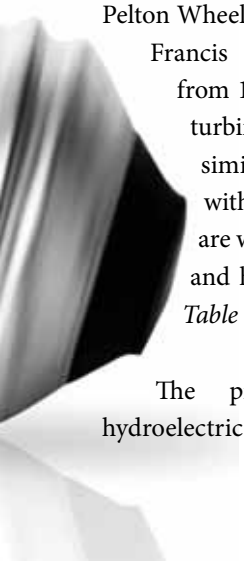
Table 1: The four largest hydroelectric power stations worldwide

proliferation of renewable energy sources emphasizes the urgency of Smart Grid operation.

HYDROELECTRIC POWER.

Hydro power has been in use since ancient times for milling grain and other applications. The first recorded use of hydroelectric power occurred in 1878, developed by William Armstrong at Cragside in Northumberland, to power a single arc lamp in his art gallery. The Old Schoellkopf power station near Niagara in the US began producing electricity in 1881. By 1889 there were 200 hydroelectric power stations in the US. The United States currently has over 2000 hydroelectric power stations that supply 6,4% of its total electrical production. The most commonly used turbine for power generation is the Francis turbine first used at the Pawtucket Gatehouse in Lowell, Massachusetts.

These are used for applications of up to 800 MW and can operate at speeds from 75 to 1000 rpm. In the past the Pelton Wheel design was commonly used. These are best suited for high pressure and low flow applications. The double-bucket Pelton Wheel dates from 1878 and the Francis turbine was developed from 1848 to 1920. The Kaplan turbine, developed in 1913, is similar to a ship's propeller with adjustable blades. These are well suited to low pressure and high flow conditions. *See Table 1.*



The proposed Grand Inga hydroelectric plant on the Congo River,

HYDROELECTRIC DAM	SITE	MW	OPERATIONAL
Hoover (Boulder)	Nevada/Arizona	2080	1936
Grande Dixence	Valais, Switzerland	2069	1965
Grand Coulee	Columbia River, Washington	6809	1942
Norsk Hydroelektrisk	Vemork, Rjukan, Norway	60	1911
Banqiao	Zhumadian, Hunan, China	2000	1952
Möhne, Eder, Sorpe	Ruhr, Germany	33,5	1908

Table 2: Dams of Historical Importance

planned for operation by 2020-2025, if completed, would become by far the largest power plant on Earth, generating 39 GW. This would require 52 Francis sets of 750 MW output each. This would be a run-of-the-river plant not requiring an excessively large dam. The turbines would work with a 150 m head of water. The Westcor partnership envisions the interconnection of the electric grids of the Democratic Republic of the Congo (DRC), Namibia, Angola, Botswana, and South Africa.

Of the thousands of large hydroelectric plants worldwide, several have become historically prominent. *See Table 2.*

The Hoover (formerly Boulder) dam has 19 turbines of various sizes of both Francis and Pelton wheel design. The dam was built across the Colorado River at the time of the Great Depression providing large scale employment.

The Grande Dixence Dam is unusual in that it has no turbine hall. High pressure water is supplied by pipeline to four power stations, Chandoline, Fionnay, Nendaz and Bieudron at lower altitude and at up 16 km away. The four Pelton Wheel power stations have a combined output of 2,07 GW. I can remember negotiating countless hairpin bends driving up the mountain road to the base of the dam. Access to the top of the 285 m wall is by cableway. The gigantic wall required six million cubic metres of concrete. The dam is mostly supplied by glacier meltwater (as well as by pumping) so that it has a maximum level in summer and a minimum level in winter, when the remains of the previous Dixence dam wall become exposed. The Bieudron power station has an astonishing working water pressure of a 1883 m head of water. Disaster struck in 2000 when a penstock ruptured.

The Grand Coulee Dam supplies 33 turbine sets in four power stations with a total output of 6,81 GW.

The Norsk Hydro power station also received its water by pipeline, with a fall of 200 m from the Hardangervidda. The power station was fitted with 6 Pelton 10 MW turbines. The power station was

Renewable Energy

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largely involved in fertilizer production since as early as 1911. This power station became a major military target when it was used for producing heavy water (a by-product of ammonia production) at the time of WW2. The plant was shut down in 1991 after producing 31 million tons of products.

The Möhne, Eder and Sorpe dams became famous on 16-17 May 1943 when they were attacked by 19 RAF Lancaster bombers using a unique design of bouncing bombs to detonate at the walls below water level. The losses of both sides were horrific. The Nant-y-Gro dam in Wales was used a test site for developing the bombs.

The Banqiao dam was the site of the worst dam disaster in history. In 1975 a combination of poor construction, failure of other dams upstream and exceptionally heavy downpours (1060 mm per day) resulted in catastrophic failure. Some 26 000 people perished in the flood and later 145 000 from famine and epidemics. Six million dwellings were destroyed.

WAVE POWER

Wave power has seen much development in Scotland where the seas provide much potential for harvesting wave energy, and local conditions provide little potential for solar power. A remarkable device known as the 'Pelamis' has been developed, which, from a distance, looks much like a tube train that has left its burrow and lost its wheels. This device was aptly named after a surface swimming sea serpent. The Pelamis consists of four or five tubes connected by hydraulic rams and which are able to flex both vertically and horizontally. The Pelamis P2 is 180 m long, 4 m in diameter and approximately 1350 tons in mass, consisting of five tube sections and four flexible joints. The rams pump oil under high hydraulic pressure which drives alternators by means of hydraulic motors. The power cable goes first to the seabed where the Pelamis is anchored and then to the shore installation. A four tube Pelamis can typically generate 750 kW of power.

The system uses a joint configuration to induce a tunable cross-coupled resonant response. Control of the restraint applied to the joints allows this resonant response to be 'turned-up' in small seas where capture efficiency must be maximised or 'turned-down' to limit loads and motions in survival conditions.

Pelamis Wave

In December 2009, Pelamis Wave Power announced a joint venture with Swedish utility Vattenfall to develop the Aegir Wave Farm off the southwest coast of Shetland. The joint venture company, named Aegir Wave Power, was planning to install a 10 MW farm using 13 Pelamis machines with a possible expansion to100 MW. Aegir Wave Power was awarded an Agreement for Lease from The Crown Estate in May 2011. The Vattenfall venture was cancelled in 2015.

Pelamis Wave Power was established in 1998 with offices and fabrication facilities in Leith Docks, Edinburgh. The company went into administration in November 2014. Joint Administrators were appointed to assess the options for securing the future for the business and employees of the marine power technology specialist. The combination of more than 350 man-years of experience, some 15 000 hours of real grid connected test data and intensive parallel R&D work, gives Pelamis a unique platform from which to develop and demonstrate the viability of its technology for commercial deployment. The Pelamis concept and design are sound and too good to be lost.

Edinburgh based Aquamarine Power, established in 2005, developed their 'Oyster' wave surge converter. This is a buoyant hinged flap attached to the seabed at about 10 m depth. Movement of the flap drives hydraulic pistons pumping high pressure water to a shore based hydroelectric turbine. Oyster units are able to generate 800 kW each. As with Pelamis Wave Power, Aquamarine Power has also folded.

It has been estimated that recoverable wave power of the UK coasts could exceed the country's entire electricity demand.

South Africa's southern Cape coast is well suited to wave energy harvesting but this would be less cost effective than photovoltaic or concentrated solar power.

Wave energy on a smaller scale can be harvested by means of vessels partly filled with air and open at the bottom. Wave surges inside the vessel could compress the air which can then be used to drive a small turbine.

TIDAL POWER

Tidal power can be generated either by the rise and fall of the tides or from the currents produced by the tides.

The proposed Russian Penzhin Tidal Project is mind boggling. The tides in Penzhin bay are the highest of the Pacific Ocean. They are 9 m in height and spring tides can reach 12,9 m. Penzhin Bay has diurnal tides (one high and one low tide per day) – this also occurs in the Gulf of Mexico and some other locations. The total tidal flow in the bay is staggering – 360 to 530 cubic kilometres. Two sites were chosen for the project. The northern site has a tidal range of 13,4 m and a potential for 21,4 GW. The southern has a tidal range of 11 m and a potential for 87,1 GW. The project would use either the northern site or the combined site.

Due to the lack of consumers in the vicinity and non availability of long distance distribution infrastructure, it has been suggested that the power could be consumed locally with power intensive industry such as liquid hydrogen production.

On a more modest scale, power can be harvested from tidal currents by means of turbines placed on the seabed or suspended beneath anchored barges.

Turbine

France's first subsea tidal power plant for Electricité de France (EDF), near Paimpol-Brehat, in Brittany is being built by a General Electric led team. The four seabed 16 metre diameter turbines 35 metres below the surface will each deliver 2 MW of power. A control unit, 16 m long and 5 m wide, known as the "yellow submarine" will be placed nearby. This will control the speed of the turbines, and convert the alternator output to high voltage DC, for transmission by a 16 km cable for conversion and connection to the grid. The turbines are so large that they had to be assembled in a dry dock in the port of Brest and deployed using a custom built barge. The turbines are designed to function without the use of oil, grease or other polluting lubricants and have a large central hole to improve sea-life safety.

An innovative tidal power plant has been planned to commence with construction in 2017 on the Welsh coast. This is the Swansea Bay Tidal Lagoon which will utilise tides channelled into an artificially constructed lagoon. Using a river mouth has been found unsatisfactory in the past due to damage to natural ecosystems. A 9,6 km rock-clad semicircular barrier will be built up from the seabed. A mouth

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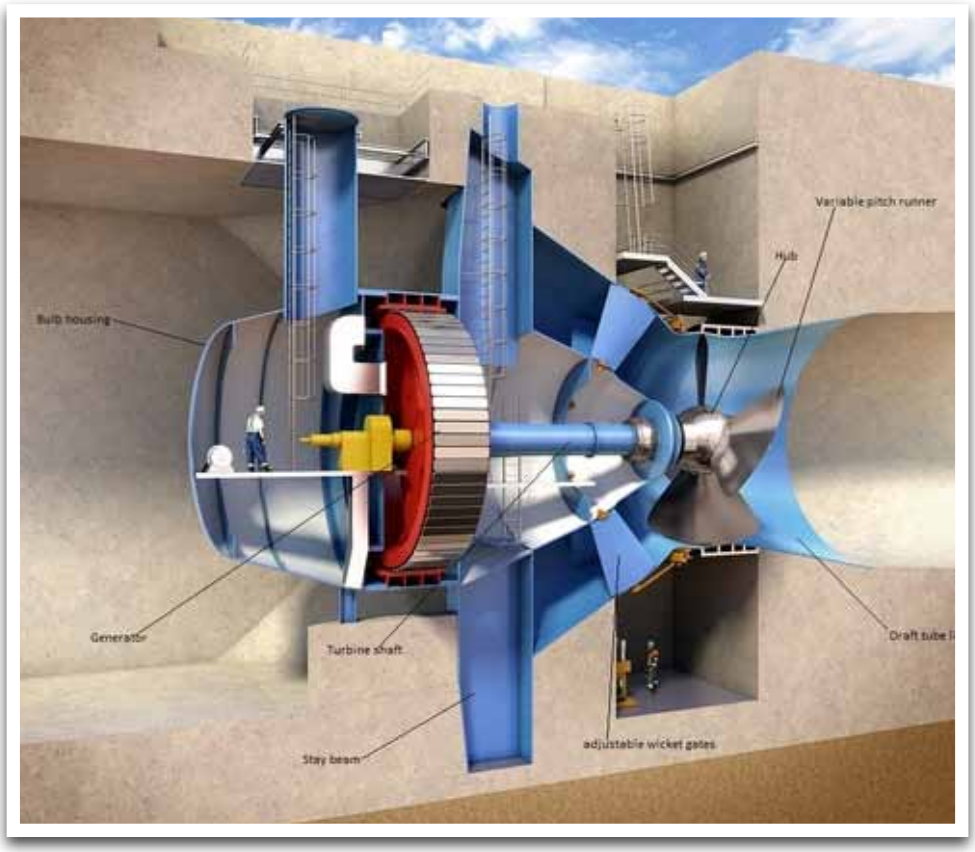


Swansea Power Turbine

in the barrier will be provided with 26 huge Kaplan underwater turbines with a combined output of 350 MW. The turbines are reversible, generating power during both inflow and outflow of water. Swansea's barrage will host a walkway, fishing spots, an aquatic community farm and a visitors' centre, while its protected lagoon could also host water sports events. The cost of the project is estimated at £1 billion. This venture, if financially viable, could well become a prototype for further tidal power installations.

The tidal lagoon project has come under much opposition and criticism fuelled by concerns over its financial viability.

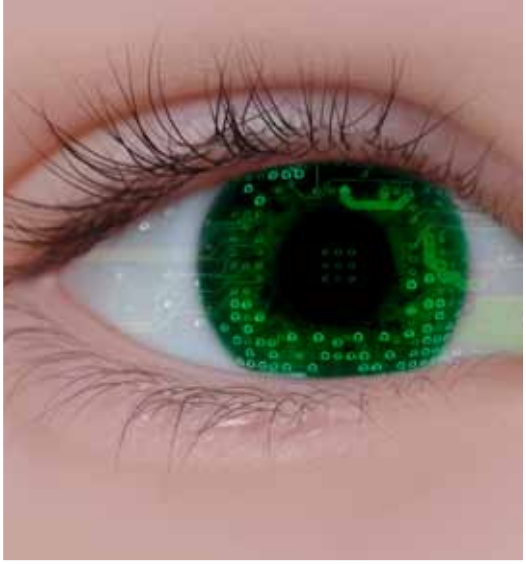
The Indian family which last year rescued the Caparo steel companies out of administration, has recently announced an eight-figure investment in tidal lagoon developer Tidal Lagoon Power. The move is part of a wider strategy by the Gupta family company SIMEC to create multi-billion pound renewable energy capacity worldwide and apply innovative technologies to provide low-cost power for energy-intensive industries, particularly steel. The lagoon developer Tidal Lagoon Power has yet to agree on a financial support agreement with the Government without which the project cannot go ahead.

Scottish registered company May-Gen is planning to install Europe's largest tidal turbine energy project. This will be in the Pentland Firth between Orkney and the Scottish mainland. The initial 9 MW project will be installed on a phased basis until 2020. The final configuration will possibly be 400 turbines delivering 398 MW. The seabed AR1000 turbines stand 22,5 m tall with a rotor diameter of 18 m.

WIND TURBINES

Wind turbines (more correctly - aerofoil-powered generators) have brought wind power full circle from the windmills introduced to Europe and the Baltic States centuries ago. The earliest known windmill used to drive a machine was developed by Heron of Alexandria in the 1st century AD. The windmills of Europe were widely used for grain milling, pumping, lumber sawing and other applications. The windmills became obsolete with the introduction of steam engines, internal combustion engines and finally electric motors. Many old windmills can still be seen on display in Holland, Greece, France and Spain.

The modern wind turbines do not have the romantic associations of Don Quixote de la Mancha, Daudet's windmill, the Moulin Rouge, de Kinderdijk Molen or the Moonspinners of Mykonos, but they do bring a clean and easily distributed source of power. South Africa has its own historical windmill on public display - Mostert's mill in Cape Town. The Dutch windmills also served as a means of communication: the sails would always rotate in an anti-clockwise direction when viewed from the sail side and when not in use would be stopped, with one sail pointing vertically for short stops or sails diagonally for long stops. Stopping a sail at an angle before or after the vertical would signal various messages – good news for a sail coming up to the vertical and bad news for a sail going down after the vertical. The familiar lattice tower farm windmills used for borehole pumping remain in widespread use.



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Renewable Energy

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Modern wind turbine farms came into prominence from about 1979. Before this, small units of a few kW or less, were commonly available for domestic or farm use. The turbines are usually mounted on tall towers to capture wind at a higher velocity but they are also sometimes mounted in innovative places such as between tall buildings and under the arches of bridges. An unfortunate aspect of wind turbines is the high incidence of bird strikes.

The first automatically operated wind turbine was built in 1887 by Charles Brush. This was 18 m tall with a multiple bladed rotor driving a 12 kW generator. The Smith-Putnam wind turbine became the world's first megawatt-size wind turbine, connected to the electrical distribution system on Grandpa's Knob in Castleton, Vermont. This had a 36 m lattice tower and a two bladed turbine of 53 m diameter driving a 1,25 MW synchronous alternator at 600 rpm. The blade pitch was controlled hydraulically to maintain synchronous speed. This would remain the largest wind turbine until 1979.

The largest wind turbine to date, the Vestas V164, introduced in 2014, is rated at 8,0 MW. This has an overall height of 220 m and a turbine diameter of 164 m.

The typical wind farm sizes and power of wind turbines has been steadily increasing from a hub height of 17 m and 75 kW power in 1979 to present day turbines with a hub height of 120 m and 5 MW output. By 2014, as many as 240 000 commercial sized wind turbines had been installed.

Wind turbines typically turn at from 13 to 20 rpm driven by winds of from 3,5 to 11 metres/sec. A gearbox raises the speed to drive the alternator at typically 1500 rpm. When excessively strong winds occur the blades are feathered to prevent overspeeding.

Blimp Turbine

The innovative designs of wind power machines are seemingly endless. Many of these are tethered to the earth by cable and are able to utilise faster wind flow at higher altitude. These include various designs of wing mounted turbines, annular blimps with central turbine and high flying kites that power an earth based installation. There is an article on kite power in the June 2014 issue of **watt**now. There are also many designs of vertical axis turbines with spiral sails.

Following the Fukushima Daiichi earthquake/tsunami and nuclear disaster on 11 March 2011, Japan's nuclear power plants, which supplied 30% of the country's power, were shut down. By 2016 only two had been restarted. A huge wind power project was launched to generate power from off-shore floating turbines. This would initially consist of a floating 25 MVA electrical substation and a 2 MW floating turbine with a 80 m rotor at 62 m hub height. Two huge 7 MW units followed with 164 m rotors at 105 m hub height. The turbines feed the substation at 22 kV which supplies power at 66 kV to the mainland. The substation and turbines are moored to the seabed by partly buoyant catenary cables. The mooring system to cater for all wave and wind conditions would have presented some extremely complex design problems. The disaster prompted several other countries to curtail their nuclear power programs.

PHOTOVOLTAIC

Photovoltaic power farms have become the most prominent source of renewable power in South Africa due to the excellent solar power availability and also the availability of non-arable land. The panels can also be installed on land used for sheep grazing.

The first 1 MW PV farm was built in California in 1982. The sizes of PV farms have steadily been rising with 1 GW farms now being considered. Land area required for fixed tilt array PV farms varies from 1 to 2 hectares per MW depending on location. Solar to electric efficiency is typicaly 15%.

Solid state power electronics is used to invert the DC output of the PV panels to 3-phase AC and prepare it for synchronisation with the grid. Grid synchronisation requires the matching of five parameters: Voltage, frequency, phase rotation, phase angle and wave form – hopefully a good sinusoidal wave that will not introduce troublesome harmonics.

A significant disadvantage in the use of PV power is the dependence on the availability of sunlight. It is assumed that available power can be accepted by the grid and possibly be stored elsewhere if supply exceeds demand, or possibly allow power station output to be reduced. After dark or on overcast days power must be available from other sources.

PV power generators can be made in almost any size from small instrument usage to industrial use. In South Africa PV farms typically have an output of up to 100 MW. Vanadium Redox batteries can be used to advantage to provide energy storage. The Vanadium Redox flow battery, although not suited to vehicle use, presents remarkable properties which make it ideally suited for use in UPS, photovoltaic and Smart Grid systems. The power output depends only on the size of the electrodes and proton exchange membrane. The energy storage capacity is limited only by the capacity of the electrolyte storage tanks.

Several huge flow batteries are in use with up to 5 MW output and several hours of energy storage. The battery is not damaged by being left discharged and can also be quickly and fully recharged by switching to standby electrolyte tanks. Energy density is typically 25 Watt-hours per kg and the charge/discharge efficiency is 75-80%.

In operation, the positive and negative electrolytes must be circulated past the electrodes and membrane by means of circulation pumps. The first successful demonstration of the vanadium redox flow battery was by Maria Skyllas-Kazacos at the University of New South Wales, Australia in the 1980s.

An exciting project has been launched in the town Carros, close to Nice on the French Riviera. This is France's first prototype smart solar grid that can allow cities to generate renewable energy closer to consumers. Carros was chosen as it is at the edge of France's transmission grid and has only one supply line. Solar panels with automatic switches and software were placed on more than 500 buildings. A one MW battery to buffer supply and demand was also installed.

The GE distributed energy resource management system allows operators to mesh consumption information from smart meters, with load forecasts and status updates from the grid and weather reports. At the town's business park 15 businesses became an 'islanding zone' generating and storing enough power to be disconnected from the grid at certain times. Dealing with oversupply is just as important as undersupply.

Consumers can be advised by text messages when to switch off water heating as well as on again. An arrangement with a coffee roaster advises him when to start roasting which helps ease the oversupply. Many countries have remote shedding of non-essential loads by means of ripple switching or long wave radio signalling. Overload conditions can also be communicated by means of TV Messages.

Concentrated Solar Power (CSP) has come into increasing prominence in several countries. The output of CSP is in the form of heat which must then be converted to electrical power. Having the energy as heat is useful as this allows for molten salt heat storage, allowing the electrical power to be generated to suit demand.

The CSP output will of course require plant for steam raising and turbo-alternator power generation, but it is also possible to obtain this from an existing coal fired power station by supplying heat. This is known as Solar Aided Power Generation (SAPG). Academic research has been done which showed that this is a viable and cost effective method of reducing the power station's coal consumption and CO_2 emission but without increasing the power station's rated output. An evaluation of SAPG appeared in the April 2014 issue of **watt**now.

The high temperatures obtainable by CSP permit heat input at any part of the steam

Renewable Energy

continues from page 47

raising plant but the most likely method of input is by reheating feedwater between the economiser and boiler. Bleedwater from the turbines is in any case returned to the feedwater part of the Rankine cycle. Introducing heat and reducing combustion must be as smooth and responsive as possible as power generation will depend on sometimes erratic sun availability.

Large CSP farms use parabolic trough mirrors with single axis tracking. The fluid used in the pipe at the focal point is usually oil which is then used to heat the molten salt or to generate steam. The high temperature pipe is a source of some infrared radiation loss. The thermodynamic efficiency of CSP is about double that of PV but this is not a major concern as there is no cost to the sunlight. There is not a significant difference in the land area required by CSP and PV.

Much research has been done with parabolic CSP dish mirrors with attached Stirling engine and alternator. This conveniently allows the generation of power without the use of steam plant and turbine. These can also be provided with a heat storage capability. Utilising the Stirling engine in a solar application was pioneered by Swedish American inventor John Ericsson in the 1870s.

With desk top Stirling engine models it is sufficient to apply heat and cooling directly to the cylinders, but this is not practical for greater speed and power. Larger engines require hot and cold heat exchangers with clusters of small bore tubes for rapid heat transfer. A regenerator (proposed by Ericsson) is placed between the heat exchangers for extra boost. It is quite practical to run a Stirling engine at alternator speed.

When fitting a Stirling engine and alternator to a parabolic dish mirror the solar power is focused to the heat exchanger at the posterior of the Stirling - somewhat reminiscent of red posterior baboons. In the case of baboons, red does not mean 'stop', rather it signals 'come and get it'. A parabolic mirror requires two-axis solar tracking adding to the complexity.

Designers of solar plant power farms would very likely baulk at the idea of hundreds of piston driven engines where PV panels with solid state power electronics could be used instead.

The Swedish United Sun Systems International Ltd offers a 33 kW Dish-Stirling CSP system with six hours of energy storage. This unit uses hydrogen as the enclosed fluid and is claimed to successfully compete with fossil fuel power, making it more cost effective than PV.

The system drives a Stirling engine at 1500 rpm and is provided with two axis solar tracking. The unit can also be provided with desalination and water purification facilities. This unit utilises a secondary mirror making it look similar to a telescope.

The Ripasso Stirling Hybrid CSP (also from Sweden) offers full solar and hybrid modularity in 33 kW units with solar to electricity efficiency of 32%. These machines are also able to use natural gas, LNG (Liquid natural gas), LPG (Liquid petroleum gas), diesel, biogas and industrial off-gas. Ripasso has set up a test site in the Kalahari desert. These machines have no water requirement and a claimed service life of 25 years. Land requirement is given as 2,5 hectares per megawatt.

Stirling radioisotope generators are being considered for spacecraft too distant from the Sun for effective solar photovoltaic power. These can be made more efficient and smaller than currently used radioisotope thermoelectric generators. Plutonium is commonly used as a heat source. The Scottish dominee would have been aghast to know that his novel heat engine design would power spacecraft at the outer reaches of the Solar System two centuries later.

The path ahead for renewable power and Smart Grids promises to be innovative, dynamic and exciting. The Stellenbosch Centre for Renewable and Sustainable Energy Studies (CRSES) acts as a central point of entry into the University for the field of renewable energy. Some contract research projects are completed within CRSES while others go to other academic departments or research entities of the University.

It remains to be seen what becomes of the three planned giga Quixotic 'Impossible Dream' projects:

- The 108,5 GW Penzhin Tidal Power Project;
- The Congo 39 GW Hydroelectric Project; and
- The Mongolian Ordos 2 GW Photovoltaic Project.

If and when Tesla's 'Impossible Dream' of 'Universal energy' and gravitation control comes to fruition we will be able to dispense with the use of fuel and wheeled vehicles and will be able to send loads of unlimited size in driverless craft from anywhere to anywhere including the Moon, asteroids and Mars. wn


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Why Being Nice to Others in 2016 could grow your Business

When it comes to running a business, 'nice' is not a word that I throw around very often.

BY | DYLAN KOHLSTADT

So when I say 'being nice can grow your business' I'm not being flippant or insincere. When I say 'be nice', you should sit up and take notice, because this perspective could be what will turn a good year into a great one.

SERVICE OR RELATIONSHIPS?

Let's face it: customer service is a foregone conclusion nowadays and will not set you apart from the pack.

Your business can rise above the rest when it shifts its focus from basic service and a good product, to relationship-building. By that I mean good, old-fashioned sincerity, mixed with genuine 'niceness' to your customers. That requires listening, responding, and taking what your customers have to say about their experience with your brand seriously.

How do we know if we're nice or not? *"Of course I'm nice. I'm the nicest person I know,"* you might say. But as with everything important, if you can't measure it, you cannot make it an achievable goal. Thankfully, there is a 'nice barometer' and it's called NPS. For those of you who don't know, NPS does not stand for Nebraska Postal Services, but rather the all-important Net Promoter Score.

WHAT IS NPS?

"How willing are you to recommend this company to someone else?" That, quite simply, is NPS. You could pretty much close this article and walk away now, as almost everything there is to know about NPS comes from that one seemingly simple question.

Your Net Promoter Score is the difference between how many of your customers are willing to promote you against those who are actually damaging your brand.

WHAT IS A GOOD NPS?

I had an experience recently that explains this perfectly. To set the scene, let me introduce the three stars in this saga:

1. Detractor – unhappy and brooding, with a penchant for revenge.
2. Promoter – loving and loyal, always ready with a kind word and full of rah-rah!
3. Passive – 'meh' describes this persona best.

So here's what happened. I bought a pair of expensive leather boots from a proudly South African company recently. They were comfortable and stylish, but aside from that I never felt a real connection to the brand,

and I had other leather boots that I switched them up with (Passive 'meh').

The next Winter came and I wore my boots again, except – without warning and for no apparent reason – one of the soles split open completely.

I reached out to the customer service people for assistance and the rather vanilla response I got was, 'courier it to us and we'll replace the sole.' Since it wasn't my fault that the sole split, I felt it unfair of them to expect me to carry the burden of the courier expense. After sharing this with the customer care person several times, with no apparent effect, I became livid and actively started attacking their brand on social media (Detractor 'revenge'). I even created a "Why I hate XYZ" board on Pinterest. It wasn't pretty.

Within days the social media manager (obviously with more authority to act than the unfortunate customer care person) contacted me and swiftly took care of my courier needs, which made me feel moderately happy again (Passive).

Then, to my surprise and delight, they sent me an additional pair of brand new boots by way of apology. I was ecstatic. Now I sing their praises every time I talk about boots, and tell all my friends about them (Promoter – rah-rah).

TRUE STORY.

What set this company apart from the rest was their recognition that customer relations, not just customer service, is the new standard. NPS measures the detractors from the promoters, and the only way to create and keep a promoter is through active, empowered client relations.

- Are you responding to the feedback you're getting from your customers?
- Are you building relationships through conversations?
- Has your frontline team been empowered to make decisions that will improve and restore client relationships?

The power of NPS is in its simplicity, but for it to be really meaningful, management needs to allocate authority to respond appropriately to its findings.

NPS AND GROWTH:

Studies by the Harvard Business Review reveal that companies make more money when their Net Promoter Score improves. This stands to reason, as a happy customer is a returning customer.

Case in point: a cellular company in South Africa recently advertised that they would spend up to R10,000 to buy out a new client's contract. I was one of their old unhappy clients (emphasis on 'was'). I guarantee you it would have cost them far less than R10,000 to convert me from a Detractor to a Promoter and enjoy a lifetime of my loyalty and hefty business contract.

If they took the time to discover the 'why' behind my unhappiness, with a bit of creativity and insight, retaining me would have cost a fraction of their current Cost of Acquisition. For growth in 2016 it is of the utmost importance for a business's leadership to investigate the "whys" behind the data, and to adapt and evolve accordingly.

You don't need to be a multi-national listed corporation to measure NPS. If you have more than two customers, then you need to know whether they are promoters, detractors or passive so that you can understand where your core issues lie. For a deeper look into your customer's wellbeing it might be worthwhile to reach out to a brand experience and customer journey expert.

If your NPS is better than your competitors', you will likely outperform the market. wn

The Finsen Time Signal Receiver

William Stephen Finsen was born in 1905 of Danish parents who lived in Parktown. He attended Yeoville government school and then King Edward VII (KES) obtaining a 1st class matric in 1923. He was inducted to the Faculty of Science Wits in 1924 at which time he performed voluntary work at the Observatory. In April 1925 a clerical position became available and he completed his BSc degree at Wits in his spare time. He obtained his MSc from Wits, and UCT later awarded him a DSc on the strength of his published works.

BY | RICHARD DISMORE | MA (CANTAB) | SMSAIEE

His duties included routine seismological and meterological observations, and the observatory time service, for which he built the receiver (described in this article) to receive the time signals from Rugby and Bordeaux.

Finsen was Union astronomer from January 1957 until May 1961, when he became the 4th Director at the now Republic observatory, until his retirement in July 1965. This provided an unbroken period of 40 years with the observatory, since he remained there on essential duties during WW2. During the war, he and his wife produced a film to train soldiers to navigate astrally in featureless territory such as the North African desert. Late in WW2 he designed a sun compass, which was used in the Italian campaign.

In 1948 he designed and made an eyepiece interferometer to reveal double stars, which are too close to be separated visually.

The Sputnik 1 satellite launched on 4 October 1957, was too small to see with the naked eye, but the launch rocket which accompanied it could be seen clearly under the South African sky, and was first photographed by Finsen on 2nd November 1957.

From contemporary comments he was a real hands on man. He had a workshop on the first floor of Innes House, and was known for his geniality and fine sense of humour. From the early 1950's he took great interest in amateur astronomy groups, and continued working as guest astronomer after his retirement, receiving the Gill medal in 1967.

The time signal receiver is not a thing of great beauty, but is a practical solution using the technology of the period. This involved some innovation in its electronic design and circuitry, and a very workmanlike approach to construction. The case is almost 1 metre wide, constructed of 19 mm pine painted Admiralty grey. The receiver is mounted on top, and a battery compartment below to contain the High Tension (HT) dry batteries and 2 volt accumulators for the valve filaments. The panel components do not all come from the same period, the earliest dating from 1915. It is possible that this receiver was reconstructed circa 1926 from previous versions, judging by the most modern components, the absence of a metal chassis or front panel, and supported by the fact that there are no spare holes in the baseboard or the front panel.

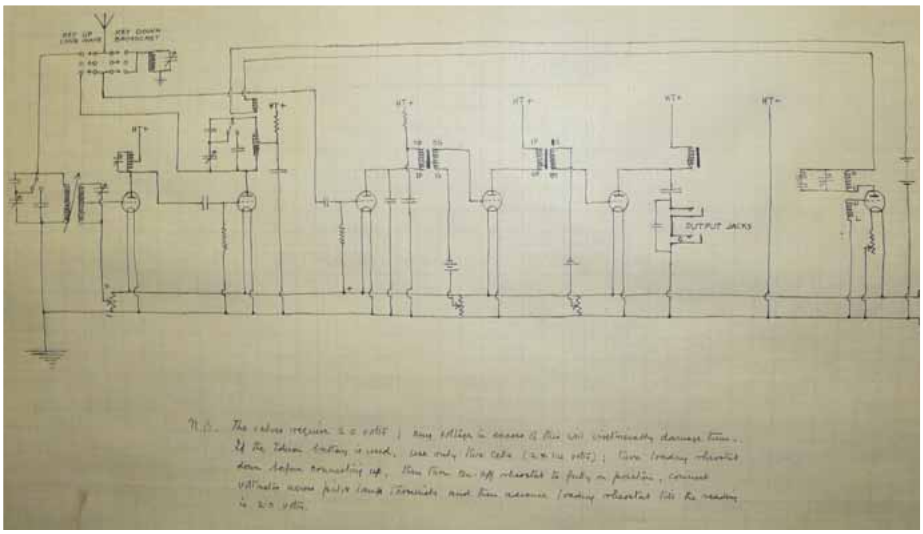
The receiver's main purpose was to copy the Very Low Frequency (VLF) signals sent by the Rugby, England station GBR on 16 kHz and the Bordeaux (Croix d'Hins) in France on 15.6 kHz.

VLF transmissions (3 kHz to 30 kHz and wavelengths from 10 to 100 kilometres) have limited bandwidth. Audio transmission is highly impractical and the transmitters cannot be keyed due to the high powers involved, typically 500 kW. Therefore only low data rate digital signals are possible using Frequency Shift Keying (FSK). The VLF band is still used today for a few radio navigation services, government time radio stations and for secure military communication. Since VLF waves penetrate about 40 meters into saltwater, they are used for military communication with submarines.

The main mode of long distance propagation is an Earth-ionosphere waveguide mechanism in Transverse Magnetic (TM) mode, derived from zigzag reflection between the bottom of the D layer of the ionosphere and earth. It is not like High Frequency (HF) signals which are returned to Earth from higher layers in the ionosphere. The F1 and F2 layers, by refraction process incurring higher attenuation. Due to the huge wavelength, the ground waves can diffract around large obstacles, and so are not blocked by mountain ranges, and follow the curvature of the earth, creating sweet-spots where the sky wave is reinforced. VLF waves have very low path attenuation, 2-3 dB per 1000 km, with little of the fading experienced at HF. Propagation distances of 5 000 to 20 000 km are usual. However,

Finsen Time Signal Receiver

continues from page 53



In Finsen's handwriting you find a neat hand drawn schematic of the receiver pinned to the underside of the lid with instructions for the 2 volt heater supply.

noise caused by atmospheric discharges is high as it propagates by the same mechanism as the VLF signal.

There is a neat hand drawn schematic of the receiver pinned to the underside of the lid, with instructions in Finsen's handwriting, concerning setting precautions for the 2 volt heater supply. There are 6 screened triodes (type PM2HL) used in the receiver. This is a conventional Tuned Radio Frequency (TRF) for receiving Broadcast medium wave with 1 Radio Frequency (RF) stage, Detector, and 2 audio stages, and a post office pattern key-switch to change the receiver to the VLF operation. This has with 2 RF stages, detector, 2 audio stages, and a heterodyne oscillator on the far RHS of the schematic.

The heterodyne oscillator is constructed in a separate enclosure completely screened with zinc sheeting. To de-modulate the VLF 16kHz FSK signal, the heterodyne oscillator was tuned in such a way that the beat with the carrier signal was inaudible, but the frequency shifted code could be read as an audio tone in the headphones.

The transmitter was keyed 61 times per minute to give a "vernier" effect to determine the distant clock error when the pulse coincided with a particular second division.

The other innovation, which tells of its constructor's first-principles understanding, is that the RF stages have a negative feedback loop designed to compensate for the "Miller effect" arising from the high anode to grid capacitance of the triodes employed.

The HT (High tension) voltage is fed to a tapping on the anode tuned circuit coil. Since HT is effectively RF earth, this neutralises the tube by feeding an anti-phase RF component into the cathode circuit rather than into the grid, as seen in the Neutrodyne (in the same manner used to neutralise RF amplifier valves, but using inductive coupling at these low frequencies)

The heterodyne oscillator is constructed in a separate enclosure completely screened with zinc sheeting

Also under the lid the vernier settings of the tuned stages condenser settings are recorded to facilitate rapid change between the Rugby and Bordeaux transmissions. Inside the battery box lid is another card which records (in the same handwriting) the battery changeovers, and shows that the receiver was still in use in March 1942.

Finsen was primarily a physicist, with the sub-discipline of astronomy, and not a radio engineer. It is not known where Finsen obtained the know-how to build the receiver, but being a scientist with an

The Hallicrafters SX28 receiver

HS Members Oliver Gerondeanos & Richard Dismore.

enquiring mind and moving in academic circles, he would have had the opportunity to acquire a deeper understanding of how to make it work. This is evidenced by the construction features employed. Working for Robert Innes as a boss would also have given him an entrée to the leading amateur radio circles of the time through Robert's son, Toby.

Reception of time signals after 1942 was switched to the USA Bureau of Standards WWVH in Hawaii on 2.5, 5, 10, and 15 MHz, and WWV in Maryland USA. Following a disastrous fire in 1940 normal transmissions resumed on August 1st 1943 after recommissioning. Both signals were received on a Hallicrafters SX28 communications receiver. Finsen acquired this SX28 for domestic listening when it became redundant, and it was donated to the SAIEE by his family after his death. It is now displayed in the SAIEE museum wireless room.

In the latter part of Finsen's career, the demand for accurate time signals around the country escalated. One interesting application was the need for accurate time stamping on Police speed traps! Quartz clocks were installed at the observatory in 1946 and these were progressively upgraded with higher stability crystals. In 1949 the SABC provided access via a landline to a low power medium wave transmitter to broadcast observatory time signals during idle time. Shortly afterwards a 100 watt HF transmitter ZUO was established at the Observatory to broadcast the time signals continuously on 5 MHz. Due to low coverage the transmitter was modified to 10 MHz, as a link to the SAPO transmitting station at Olifantsfontein, which rebroadcast on HF at 4KW, and later over the FM broadcasting network during Idle time at night.

The Caesium atomic clock, with an accuracy of 1 second in 30 000 years, was installed at the observatory in 1966, a year after Finsen's retirement, but this was while he was still actively involved with the Observatory. This was used to standardise the quartz clocks, and must have been the culminating satisfaction for Finsen, who had been continuously solving the problem of accurate time signals for forty years.

The Finsen time signal receiver is now displayed in the Heritage room of Innes house, in the SAIEE Museum collection. wn

IN MY OPINION : RICHARD BOSMAN

Alignment of the STARS

ISO: 9001; ISO: 14001 & ISO: 45001: An Integrated Approach for Safety, Health, Environmental and Quality Management Systems

BY | RICHARD BOSMAN

Industry is abuzz with the conversion of the BS-OHSAS 18001 Standard to an ISO Standard which will be termed ISO 45001 (expected in October 2016). However with the conversion, come changes. These changes however are designed to bring into alignment all the management system standards, ISO 9001;14001;145001. The International Standards organisation (ISO) has used the opportunity to align the standards, to bring both the 9001 and 14001 standards in line with the modern organisation and simplify implementation for any organisation, both large and small.

MAIN ADVANTAGES

- Enhanced compatibility of standards
- Easier to implement new standards
- Easier to integrate standards into a management system

It is important for organisation to note that none of the above mentioned standards have been issued. Draft documents have been issued for comment, these are not the final documents and they may well change following consultation. Consequently training courses which purport to train industry on "the new standards" are not training people on the new standards as they have not been published.

HIGH LEVEL STRUCTURE WITH CLAUSES & SUB-CLAUSES

1. Scope
2. Normative references
3. Terms and definitions
4. Context of the organization
   - Understanding the organization and its context
   - Needs and requirements
   - Scope
   - Management System
5. Leadership
   - General
   - Management commitment
   - Policy
   - Roles, responsibility and authority
6. Planning
   - Actions to address risks & opportunities
   - Objectives and plans to achieve them
7. Support
   - Resources
   - Competence
   - Awareness
   - Communication
   - Documented information
8. Operation
   - Operational planning and control
9. Performance evaluation
   - Monitoring, measurement,
   - Analysis & evaluation
   - Internal audit
   - Management review
10. Improvement
    - Non conformity and corrective action
    - Continual Improvement

CONCLUSION

Because these standards have only been issued in draft, organisations should not feel under any undue pressure to start any amendments to their internal management systems just yet. From the date on which these standards are released, they will have a three year transition period. Remember, if they are currently certified, they will remain so during the transition period. Employers should not feel any need to send employees for any training on any of these standards, these are still in DRAFT status. So far as transition training goes, sit tight and wait. There is no urgency to undertake unaccredited training based on a draft standard will not give you any advantage but it could be a waste of money. wn

STRUCTURAL ALIGNMENT OF STANDARDS			
	ISO 9001	**ISO 14001**	**ISO 45001**
4	Context of the Organization	Context of the Organization	Context of the Organization
4.1	Understanding the organization and its context	Understanding the organization and its context	Understanding the organization and its context
4.2	Understanding the needs and expectations of interested parties	Understanding the needs and expectations of interested parties	Understanding the needs and expectations of workers and other interested parties
4.3	Determining the scope of the quality management system	Determining the scope of the environment management system	Determining the scope of the OH&S management system
4.4	Quality management system and its processes	Environment management system	OH&S management system
5	Leadership	Leadership	Leadership
5.1	Leadership and Commitment	Leadership and Commitment	Leadership and Commitment
5.2	Quality Policy	Environmental	OH&S Policy
5.3	Organisational roles, responsibilities and authorities	Policy	Organisational roles, responsibilities, accountabilities and authorities
5.4		Organisational roles, responsibilities and authorities	Participation, consultation and representation
6	Planning	Planning	Planning
6.1	Actions to address risks and opportunities	Actions to address risks and opportunities	Actions to address risks and opportunities
6.2	Quality objectives and planning to achieve them	Quality objectives and planning to achieve them	OH&S objectives and planning to achieve them
6.3	Planning for changes		
7	Support	Support	Support
7.1	Resources	Resources	Resources
7.2	Competence	Competence	Competence
7.3	Awareness	Awareness	Awareness
7.4	Communication	Communication	Information & Communication
7.5	Documented Information	Documented Information	Documented Information
8	Operation	Operation	Operation
8.1	Operation planning and control	Operation planning and control	Operation planning and control
8.2	Requirements for products and services	Emergency preparedness and response	Management of change
8.3	Design and development of products and services		Outsourcing
8.4	Control of externally provided processes, products and services		Procurement
8.5	Production and service provision		Contractors
8.6	Release of products and services		Emergency preparedness and response
8.7	Control of nonconforming outputs		
9	Performance Evaluation	Performance Evaluation	Performance Evaluation
9.1	Monitoring, measurement, analysis and evaluation	Monitoring, measurement, analysis and evaluation	Monitoring, measurement, analysis and evaluation
9.2	Internal audit	Internal audit	Internal audit
9.3	Management review	Management review	Management review
10	Improvement	Improvement	Improvement
10.1	General	General	Incident, nonconformity and corrective action
10.2	Nonconformity and corrective action	Nonconformity and corrective action	Continual improvement
10.3	Continual improvement	Continual improvement	

Sourced from International Standards Organisation ISO: http://www.iso.org/iso/home.html

EXPERT ADVICE

WATT?

EXPERT INDUSTRY ADVICE

WATT? is a forum related specifically to the industrial and commercial electrical sector.

Do you have any burning questions, topical issues or points of interest about the electrical industry, from the perspective of a contractor, supplier or professional service provider? Submit your comments, thoughts, ideas, suggestions or questions for the attention of our industry experts, and these will be addressed in a future issue of the magazine. This is your forum, and we would like to hear from you!

The rapid pace of technological change and product development is a global trend that affects entire economies. We may have access to more information than ever before, but is this information readily understandable? Does it give us insight into the fundamental issues? Is it precise and based on technical clarity?

WATT? is an opportunity for people on the ground to engage with each other and related professionals in an informative and friendly manner. This is a platform for you to discuss anything related to your particular sector, to highlight anything new, or to ask a specific question related to a technical topic or to engage in general industry issues. . Please note that we will not be considering anything related to the domestic sector, such as residential wiring.

We hope that this section of the magazine not only becomes a regular feature, but that it is widely read and distributed among your peers. Remember, it can only become a success with the full participation of our readers! Send your burning questions to minx@saiee.org.za - subject 'WATT?'.

We look forward to hearing from you.
- Ed

QUESTION ONE

My farm requires irrigation and I would like to know how I would benefit from purchasing an energy efficient motor.

ANSWER ONE

Energy costs are one of the largest expenses a farmer has to face when it comes to irrigation. With ever rising energy costs, farmers have to critically consider all options and especially those that will offer energy savings. An area where savings can be realised is by using high efficiency motors which are engineered to reduce energy consumption.

Between 80 and 90% of the total cost of ownership of an electric motor is attributed to electricity costs. Owing to South Africa's consistently low cost of electricity pre-2008 this was not a major consideration when selecting the efficiency class of a motor but this has, however, become ever more critical with the increased cost of energy. In 2007, the energy costs were an estimated R10 800 per year for a 22 kW (91 % efficiency) motor. As things stand presently it costs the farmer an estimated R76 000 to run the same motor for the same period.

It is fairly simple to calculate the energy requirements for a pump and the amount of electricity that a sprinkler system requires is determined by:

- The flow rate (amount of water pumped per hour); and
- The pressure (difference in height, pressure required for the nozzles and friction in the chosen pipe diameter) at which it should be delivered.

Generally when selecting an electric motor for a pump application, an exaggerated safety factor is considered by most designers. This often leads to the scenario of a larger than necessary electric motor being selected. The result of oversizing the motor is that it will run at a less than optimum load duty. The efficiency of an electric motor is at its best between 75% and 100% of load.

Any reputable motor/automation supplier should be able to assist you with this and make optimum recommendations.

QUESTION TWO

Is the use of high efficiency motors worth the capital cost?

ANSWER TWO

The initial capital cost of a high efficiency motor is only a fraction of the total operating expense, and it is important to note that the efficiency of the motor will make a significant difference in the operating cost. The cost of a high efficiency 22 kW motor (92.2% efficiency) is approximately R75 032 per year. If you compare that to the operational cost of the standard motor (91% efficiency) you will see a saving of R 1 155 per annum on a 1.2% efficiency difference. This clearly shows that even the smallest difference in efficiency in a motor makes for a significant difference in operational cost.

QUESTION THREE

What are the benefits of installing a Variable Speed Drive (VDS) to my irrigation system?

ANSWER THREE

A centrifugal pump has a variable torque, thus we can apply the "Law of Affinity". This means that the power varies proportional to the cube of the speed.

Let's assume that you only need to run the motor and pump combination at 80 % of normal speed to get to a required pressure. If we apply the "Law of Affinity" it is calculated that you will only be using 51.2% of the power.

The example below shows a practical situation.

$$\frac{P1}{P2} \sim \left(\frac{N1}{N2}\right)^3$$

The irrigation system may have a pumping system that delivers 6 bar pressure at 100% speed which is perfect for the pivot, but the farmer may alternate between pivot and micro Irrigation. The micro irrigation might only require a 3 bar pressure. In many cases the farmer would then "choke" or "throttle" the valve leading to the micro irrigation system. The motor will still be running at 100%, but will only deliver half of the capacity required. In other words, in this scenario, the farmer is paying the energy cost in full, but only getting half the delivery in return.

Coupling this motor set up with a VSD, the farmer will be able to lower the speed of the motor to achieve the 3 bar required and only pay the cost of the energy consumed while running at this lower speed. wn

Planning for Nuclear Generation

In the 1970's and 80's, Eskom identified five sites that could be suitable for building a Nuclear Power Station. These are all situated at the coast as water in most of the country is scarce and sea water is then used for cooling purposes.

BY | MIKE CARY **|** FSAIEE

Sites on the Kwa-Zulu coastline were discounted because of the deep sands on the shore-line, resulting in high costs and low practicality of using this coast. In future it may be possible to use inland water resources as KZN is a reasonably wet province.

The first was Duinefontein which now houses the Koeberg Power Station.

Bantamklip, situated near Hermanus was also identified. This site has subsequently been put on hold because of the mountainous terrain which makes it difficult to build transmission lines to and from the station. Bantumklip is owned jointly by Eskom and the Government.

Two sites were identified on the west coast: "Brazil", and "Schalkfontein". These were also discounted because they were too far away from any load centres and transmission costs would be high and efficiencies lower.

The final site was Tuispunt, about 100 kilometres west of Port Elizabeth. The Environmental Impact survey has been completed, and most of the property has been purchased by Eskom. At this stage Eskom are acquiring land for access roads, etc.

Previously, it was mentioned that one of the options was to install two 1600 MW units at Koeberg, and four 1600 MW units at another site (Tuispunt) - totalling 9600 MW.

The current thinking however, seems to be the installation of four 1200 MW units at one power station. This would be the equivalent size to Medupi. This is also the preferred size for the Russian units.

This would make for a better security of supply. To illustrate this, assume that the installed capacity is 4 800 MW. A 1600 MW unit going out of operation would mean losing three and a third percent of your capacity, whereas 1200 MW would mean only two and a half percent.

Besides any unplanned maintenance, due to the machine tripping out, the machines have to be re-fuelled periodically. The refuelling cycle at Koeberg is currently about 51 days. This period is also used to undertake planned maintenance.

Looking to the future, many of the coal stations will come to the end of their lives, and it may be feasible to build a nuclear station on the coal station site, and save dramatically on infrastructure costs. In this case, one would probably use dry-cooling technologies. wn

calendar

MARCH | APRIL

MARCH 2016

1-2	Design Of Economical Earthing Systems For Utility Installations	Johannesburg	roberto@saiee.org.za
9-10	Advanced Microsoft Excel For Engineers	Johannesburg	roberto@saiee.org.za
15-16	Power & Electricity World Africa Conference & Expo	Sandton, Johannesburg	www.terrapinn.com
16	Power Transformer Unit Protection And Testing	Johannesburg	roberto@saiee.org.za
17	Power Transformer Operating And Maintenance	Johannesburg	roberto@saiee.org.za

APRIL 2016

5	SAIEE AGM	Johannesburg	geyerg@saiee.org.za
6-7	Leadership & Management Principles & Practice Engineering	Johannesburg	roberto@saiee.org.za
12	Electric Cables & Jointinh & Termination	Johannesburg	roberto@saiee.org.za
15-16	Power & Electricity World Africa Conference & Expo	Sandton, Johannesburg	www.terrapinn.com
20-21	MS Project Professional 2013	Johannesburg	roberto@saiee.org.za
20-21	Fundamentals of Power Distribution	Johannesburg	roberto@saiee.org.za

March |

Movers, shakers and history-makers

COMPILED BY | JANE BUISSON-STREET
FSAIEE | PMIITPSA | FMIITSPA

1 MARCH

1921 Harry Houdini, the master escapist, was granted a patent for a "diver's suit" which the wearer could easily remove while submerged underwater.

2 MARCH

1923 The first of Time Magazine was published and consisted of 32 pages.

3 MARCH

1821 Thomas Jennings, a tailor and later dry-cleaner, received a patent for "dry scouring of clothes".

4 MARCH

1924 The song "Happy Birthday To You", was published by Clayton F. Summy Company under the request of employee Jessica Hill.

5 MARCH

2012 'The Lorax' a 3D-animated film, earned $70.7 million at the box office on it's debut.

6 MARCH

2006 The South African film Tsotsi received the Oscar for the best foreign film at the Oscar awards in Hollywood

7 MARCH

2011 Pablo Picasso's "Nude, Green Leaves and Bust" went on display in London's Tate Gallery and at the time was the world's most expensive painting ever auctioned (US$106.5 million).

8 MARCH

1994 Don Ku was granted a patent for an item most travellers cannot do without, a wheeled suitcase with a collapsible towing handle.

9 MARCH

1934 Russian cosmonaut Yuri Gagarin was born in Gzhatsk, Russia. He became the first human in space, orbiting in a capsule 187 miles above the Earth's surface in a flight lasting 108 minutes.

10 MARCH

1990 Mdantsane, born Welcome Ncita, became the first South African to win the International Boxing Federation (IBF) world bantam weight title. Known as "The Hawk", Ncita went on to defend the title seven times.

11 MARCH

1302 Shakespeare's characters Romeo and Juliet were married this day.

12 MARCH

1935 England established the first 30 MPH speed limit for town and village roads.

13 MARCH

1888 De Beers Consolidated Mines Ltd. was founded to exercise control over virtually all diamond production in South Africa.

14 MARCH

1984 Koeberg, South Africa's nuclear power, became operational.

15 MARCH

2015 Boston, Massachusetts, U.S., reached a new snowfall record of 108.6 inches.

16 MARCH

1963 "To Kill A Mockingbird" the movie, based on Harper Lee's novel was copyrighted.

17 MARCH

1845 The first rubber band was patented by Stephen Perry of London.

18 MARCH

1992 South Africans voted for change by an overwhelming majority in a referendum to end apartheid.

19 MARCH

1649 The House of Commons of England passes an act abolishing the House of Lords, declaring it "useless and dangerous to the people of England".

20 MARCH

2015 It was announced that Aducanumab, a new drug developed by Biogen to treat Alzheimer's, is showing success in reducing toxic brain plaque and decreasing the rate of mental impairment in trials; if successful in further testing, the drug may be available by 2020.

21 MARCH

1990 Namibia became independent after 75 years of South African rule.

22 MARCH

1963 The Beatles' first album, "Please Please Me", was released in the UK.

23 MARCH

1839 The initials "O.K." were first published in The Boston Morning Post. Meant as an abbreviation for "oll correct," a popular slang misspelling of "all correct" at the time, OK steadily made its way into everyday speech worldwide.

24 MARCH

2015 It was announced that H.J. Heinz Co. and Kraft Foods Group Inc. would merge to form the third-largest global food company, Kraft Heinz Co.

25 MARCH

2014 U.S. Girl Scout Katie Francis broke the record for selling cookies for the organization's annual fundraiser. She sold 18,107 boxes over a seven-week period!

26 MARCH

1898 A proclamation was published in the Gazette of the ZAR which prohibited hunting in the area that is now the Kruger National Park.

27 MARCH

2014 Doctors announced that a 3D-printed plastic skull had been successfully used to replace part of a real skull in an operation.

28 MARCH

1933 The Imperial Airways biplane City of Liverpool is believed to be the first airline lost to sabotage when a passenger set fire on board.

29 MARCH

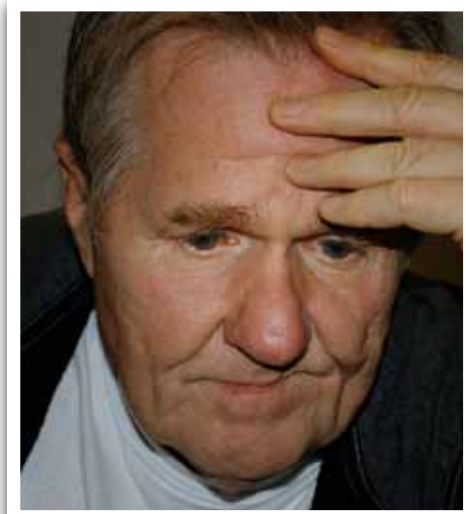
1871 The Royal Albert Hall of Arts and Sciences was opened and named by the Queen in memory of her late husband, Prince Albert, who had died six years earlier.

30 MARCH

1842 Ether anesthesia was used for the first time, in an operation by the American surgeon Dr. Crawford Long, when he removed a tumour from the neck of his patient.

31 MARCH

2013 Once the world's fastest computer, the IBM Roadrunner, was decommissioned; advances in chip design have surpassed its capabilities. Roadrunner was a supercomputer built by IBM for the Los Alamos National Laboratory in New Mexico, USA. wn



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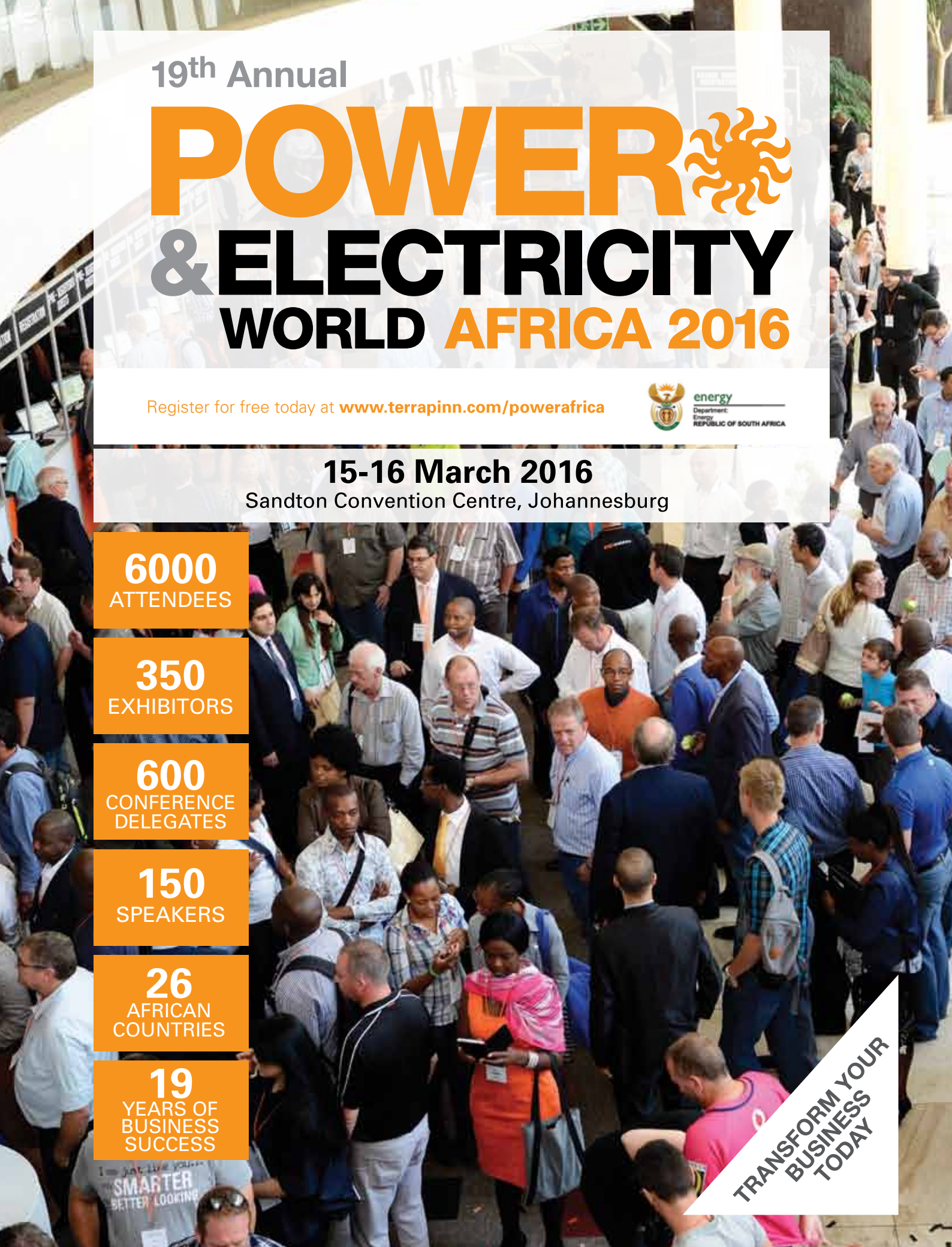

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