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wattnow

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October is upon us, and within a few weeks, we will start hearing Christmas bells!! I cringe to think that this year is nearing an end, very fast and furiously.

This issue of **watt**now features Education & Skills Development, which is a very hot topic in the media at the moment.

With Engineering being one of the critical skills in the country, we need to encourage our youth to study engineering.

Page 28 features the 2015 Bernard Price Memorial Lecture talk, presented by Prof Saurabh Sinha. The education landscape is changing rapidly, and with that, creates a new "Generation C" scholar.

The SAIEE reports on the 2015 Bursars, and you can read more about them on page 36.

With South Africa being in the news about our nuclear prospects, Antonio Ruffini takes a no-nonsense stance with his article on the "Politics of nuclear power in South Africa." Read more on page 40.

I would urge our members to actively recruit a new member to the SAIEE. You will receive 20% off your 2016 membership fees for each new member. If you recruit 5 new members, and they qualify, you will receive your 2016 membership for free!! An opportunity not to be missed. The closing date for this membership drive is 30 October 2015.

Herewith the October issue, enjoy the read.

Minx

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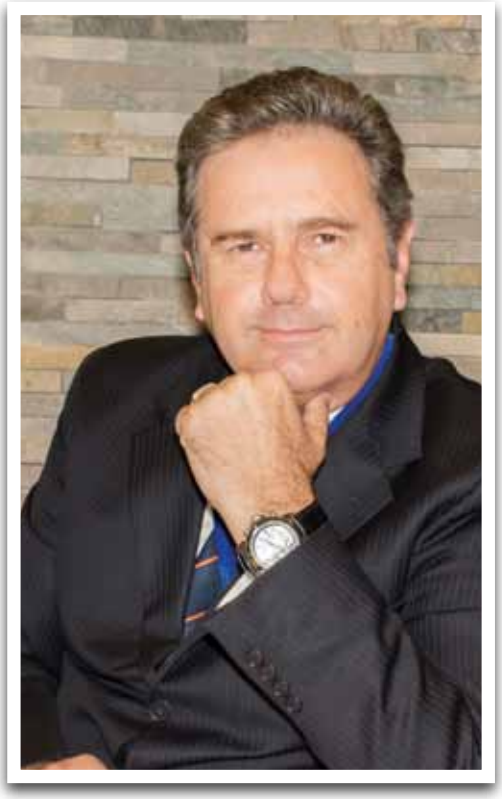

André Leo Hoffmann
2015 SAIEE President

Symptoms of the widening economic gap between the wealthy and the marginalised, globally and in South Africa, are not difficult to find. One of the keys to stem this breach is to focus on education and skills development. As the economic opportunities are becoming fewer, or more demanding in respect of skills, then we have no choice but to lift skills levels in the pool of labour to meet the new requirements.

It is a matter of survival, when viewed in the context of a globally competitive environment, to not just individual survival, but to a national imperative.

Systemically this is a challenge that requires a concerted team effort across multiple levels and multiple time frames, which brings me to the #PayItforward 'soap-box'.

Technology enablers like the Internet, ubiquitous and cost effective broadband, along with content applications such as Massive Open Online Courses (MOOCs) and other such initiatives are becoming more accessible. At the same time we need to remember to give momentum to the skills pipeline at the right times.

Developing science and engineering skills is all about timing.

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- Timing that favours the selection of maths and science at for the critical Grade 10 gateway point; and
- Timing that stimulates a healthy quota of confident learners ready to take on the maths and science journey of discovery.

During my travels to visit institutions around the country I have been encouraged to have encountered passionate people, as well as focused and motivated students, hungry for knowledge and skills. It is this, often hidden, effort that gives me confidence for the future of our country.

It is difficult sometimes to find the positive message in the South African news, but if one takes the time to look just a little deeper at what is happening with, for and by our young people there is reason for hope.

I salute the efforts of the academic staff and administrators who have the vision to invest in the fertile young minds and have the perseverance to nurture the love of the language of mathematics and the beauty of science.

Let's hope we can hold onto them in this global village.

André Hoffmann
Pr. (Tech.) Eng | FSAIEE

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The SAIEE is offering all current members the opportunity to qualify for free membership in 2016!

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WATTSUP

wattnow High Tea supports the Sunflower Fund

Minx Avrabos, Managing Editor of the wattnow magazine, recently hosted a High Tea in aide of the Sunflower Fund. The Sunflower Fund is a non-profit organisation based in Cape Town, South Africa, with a vision to give all South Africans diagnosed with leukaemia and other life-threatening blood disorders the chance of life, irrespective of their race and financial circumstances.

The SAIEE Council Chamber was once again transformed into a haven with sunflowers, organza in pastel colours and lace. The ladies (and two gentlemen) really felt at home, whilst sipping champagne (and tea).

The guest speakers, who had carte blanche on what they were talking about, had the guests riveted in their seats. The speakers were Liz Fisher, Avon; Ntombi Mhangwani, Schneider Electric; Shelby Zimmerman, Sunflower Fund; Jackie Owgan, Magnetic SA and Ulandi Exner, President of IITPSA.

The event would not have been a success without the following sponsors: Actom, Avon, Bergman Fisher, Honey Jewellers, Impact Energy, Magnetic SA, Make-up by Maureen and PPS. Thank you.

The ladies from Honey Jewellers

Liz Fisher from Avon

Vaughn & Jackie Owgan from Magnetic SA

From left: Talia Jacobs (Impact Energy), Claire Clarence and Jane Buisson-Street.

From left: Joanne Griffen, Dudu Madondo and Sue Moseley.

From left: Ntombi Mhangwani & Macy Seperere (PPS).

From left: Liz fisher, Avon and Gerda Geyer, SAIEE.

The SAIEE Girls - from left: Tracey Human, Sue Moseley and Ansie Smith

Minx Avrabos (Managing Editor, wattnow) with Shelby Zimmerman of the Sunflower Fund.

Sharon Stobbia, Elsa Swiegers & Debbie Riddle (Actom).

Ulandi Exner, President IITPSA.

The Sunflower Fund ladies with Maureen Naidoo.

WATTSUP

Schneider Electric solidify local manufacturing success with Steelcore Power

From left: John Farren, CEO at Steelcor Power signing the documentation with Eric Leger, country president for Southern Africa - Schneider Electric.

Schneider Electric, a global specialist in energy management, has entered into a production partnership agreement with Steelcor Power (Pty) Ltd, a South African manufacturer of electrical products, to produce its next generation of smart grid-ready, medium voltage (MV) switchgear, Premset.

Built using a Shielded Solid Insulation System (2SIS), Premset lets MV network operators increase safety and efficiency while simultaneously minimising downtime and meeting the needs of the smart grid. 2SIS is a technical breakthrough that protects all the switchgear's live parts with earth-screened solid insulation, reducing the risk of internal arcing and facilitating top performance in practically any environment.

To prepare for production, Steelcor Power has added 900 square metres to its factory in Boksburg, an area that has been enhanced with a three-ton gantry crane, a new test bay with a partial discharge faraday cage, and specialised equipment to manufacture Premset.

The first unit is expected to roll off the line for inspection by Schneider Electric France at the end of October 2015. A further 14 units are planned for this year, and production for 2016 will scale up to 200 units with an annual increase of 20 percent.

Two Steelcor Power staff members, responsible for the new production, have received technical training on the manufacturing process of Premset from Schneider Electric personnel in France, and local Schneider Electric specialists have and continue to offer training in South Africa.

The production agreement has also seen Steelcor Power employ an additional three people this year, with a further seven employees to be appointed next year.

"We are excited about the prospects of Premset – both from a local manufacturing point of view and enhancing the value chain of this product for the benefit of our customers. Steelcor Power has a long history of excellence in manufacturing of electrical products, and we are confident that through our partnership, we will meet the demand for Premset in the African marketplace.

We are proud to be the first country in the world to manufacture Premset outside of Schneider Electric manufacturing plants and believe that this ground-breaking partnership presents many new opportunities for manufacturing on the African continent," said Eric Leger, country president for Southern Africa at Schneider Electric, at the signing of the licence agreement with Steelcor Power.

At the event, John Farren, CEO at Steelcor Power, added: *"Steelcor and Steelcor Power have been business associates of Schneider Electric for the past 25 years. During this time, we have developed products for Schneider Electric locally, and have promoted the organisation's products for supply within our product range. Today, we are one of the major users of Schneider Electric MV switchgear in South Africa. Premset is a natural addition to our existing product range."*

Eaton launches its first ever Experience Centre in South Africa

Power management company, Eaton, launched its first ever Experience Centre in South Africa recently. The Centre is specifically designed to showcase Eaton's innovations and demonstrate how they benefit customers in key segments including commercial construction, renewable energy, data centres, oil and gas, mining, utilities. It also exhibits Eaton's innovative products and solutions for customers operating in mobile and industrial hydraulics applications as well as in the automotive industry.

Having been in Africa since 1927, Eaton understands the local needs of its customers. This can be seen through the numerous practical demos at the Experience Centre which simulate real time solutions for local industry challenges.

During this event, Eaton also launched the Hybrid Inverter, an energy saving and backup power system that allows for continued power during load shedding. It runs on energy from the sun and can power small to medium enterprises amongst others switching between main power, solar power as well as battery power - depending on availability. This solution comes at an excellent time as South African businesses are in need of alternative power solutions that ensure uninterrupted productivity and profitability during power outages.

"There is no better time to launch the Hybrid Inverter as the demand for uninterrupted and affordable power continues to grow at an alarming rate. This solution is advantageous to all sectors providing secure power and, in turn, up time in productivity. A need was identified to provide an alternative for the African market when it comes to continuously running power and I encourage business to take the time to come to the Experience Centre to view this innovative solution which promises nothing but reliability, safety and cost efficiency and will be available to customers soon," said Shane Kilfoil - Managing Director at Eaton, Africa.

"Eaton's unparalleled dedication to leadership in mobile and industrial applications has made us one of Africa's preferred suppliers of hydraulic solutions and we are excited to have our latest innovations demonstrated at the Experience Centre", said Craig de Vasconcellos - Regional Sales Manager for the hydraulics division at Eaton, Sub-Saharan Africa.

"We also provide automotive and commercial vehicle manufacturers in South Africa with products and systems that are designed to improve a vehicle's overall efficiency, performance and safety. At the Experience Centre, visitors can gain first-hand experience of our highly engineered products and solutions," said Tom Kellett - Sales, Technical Support & Aftermarket Manager for the vehicle division at Eaton, Africa.

The capabilities of this Experience Centre will allow visitors to engage with Eaton's business consulting experts from across the region. This will ensure they are fully prepared to make informed decisions on the best solutions for their businesses.

Femmegineering High Tea at the Engineering Faculty of the North-West University

The proportion of women in engineering is very low in comparison to the demographics of our country. Therefore there is a great need for an increase of women in the workforce in the different engineering fields. To address this issue, and to celebrate women's month, the Faculty of Engineering at the North-West University's Potchefstroom Campus decided to host an innovative function to encourage young women to consider a career in Engineering.

On 14 August 2015, the faculty hosted its very first Femmegineering High Tea, the brain child of Prof Liezl van Dyk and Dr Leenta Grobler. To this afternoon of opulence, a number of girls currently in grades 11 and 12, who comply with the admission criteria for a degree in Engineering, along with their mathematics and science teachers, were invited. A stylish high tea and a fashion show awaited them in the Engineering building.

Approximately 100 girls attended the function and were inspired by motivational speeches from two current women in engineering and NWU alumni, Izelle van Niekerk and Nthabiseng Modiri. They shared their personal experiences as women Engineers and encouraged the girls to seriously consider a career in Engineering and to follow their hearts in what they want to achieve with their lives. The dresses for the fashion show were supplied by celebrity fashion designer Anelle Botha

and were modelled by female engineering students. This was done specifically to change the perception that the girls might have had about the "boxes" than women in engineering may fit into. The girls enjoyed the high tea immensely.

WATTSUP

Actom secures Ekurhuleni Contract

Ekurhuleni Metropolitan Municipality has awarded ACTOM Protection & Control (P&C) a three-year contract for the provision of state-of-the-art maximum demand meters for measuring and monitoring electricity use by bulk consumers.

Bulk consumers comprise mainly large commercial and industrial businesses. The demand meters P&C has been contracted to supply are those produced by its China-based metering technology partners.

Ekurhuleni Municipality placed its first order with P&C shortly after the award of the frame main contract early last year. The order, for the supply of 1150 three-phase current transformer- and/or voltage transformer-operated maximum demand meters in the voltage range of 58 V to 415 V, was supplied on schedule in October last year.

"The meters we supply form part of an integrated Automated Meter Reading (AMR) system that is being established at Ekurhuleni," explained Leon de Nysschen, P&C's Manager, Electrical Metering.

"Another specialist service provider has been contracted to provide the AMR service, which collates and interprets the data provided by our meters and makes it available through a web interface to Ekurhuleni for billing and monitoring purposes."

The AMR system uses a General Packet Radio Service (GPRS) modem that interfaces with the bulk meter and, via an Access Point Name (APN) network, collects the metered data from the bulk consumers, processes it into the form required by Ekurhuleni and makes it available via the Internet to the municipality's data centre.

"As part of our bulk meters supply contract we are required to provide the metering protocol in order for the AMR system to be developed to translate the metered data into a form that the AMR system is able to read and interpret," said De Nysschen.

Lerato Kumalo, Technical Sales person in ACTOM Protection & Control's metering department, displays one of the maximum demand meters being supplied for Ekurhuleni's AMR system.

Denver/Rogowski Current Measurement

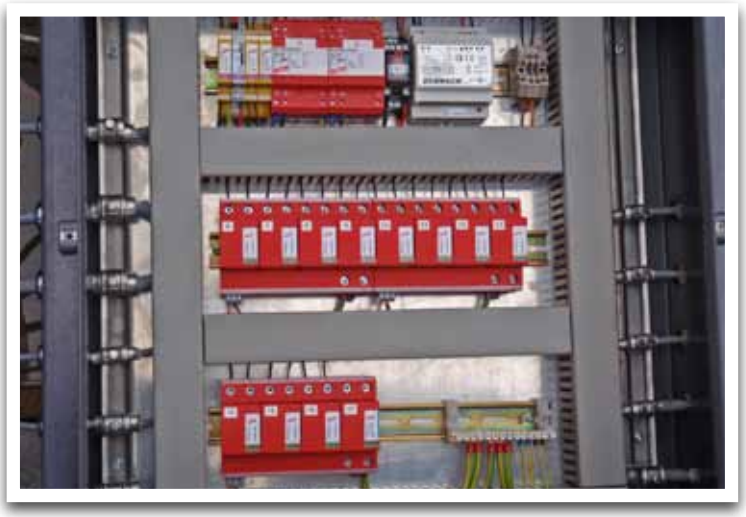
Denver Technical Products now offer Rogowski based high current AC measurement systems.

The CTRS family is capable of measuring from 1kA up to 40kA utilizing a Rogowski head which will fit busbars/bus-tubes from 165mm up to 540mmØ.

The signal from the Rogowski head is processed by an integrator and industry standard outputs are available, i.e., 0-5V DC, 0-10V DC, 0-1mA DC or 4-20mA DC.

Instrument power of 115/230V AC is required and the accuracy is ±1% with a linearity of ±0.25%. As there is no iron core, installation is simplified where space is at a premium.

Lightning and surge protection for highway gantry signs



Highway guidance systems are attached to gantry signs spanning carriageways and ensure optimal traffic control. They are supposed to prevent congestion and risks caused by accidents, heavy rainfall and excessive speed.

Highway gantry signs are used to hold traffic-specific detection systems such as CCTV cameras, induction loops and radar detectors. On toll roads, additional detection devices are installed which ensure fully automated toll data identification.To prevent a direct lightning strike damaging the display modules, it is advisable to install an isolated lightning protection system. This would be fixed directly on the structure by means of air-termination rods and isolated spacers, or a patented high-voltage-resistant and insulated HVI conductor. Thus, flashover of lightning currents to the components of the highway gantry sign is ruled out.

The highway gantry signs profile between the carriageways is earthed via radial earth electrodes or earth rods, such as those made of stainless steel. The power and control cables between the control cabinet and the gantry sign are protected against lightning strikes by a buried conductor, also stainless steel. This is the second earth-termination system of the highway gantry sign. In South Africa, stainless steel is a viable alternative to copper, due to the high theft rate of copper in SA.

In the control cabinet, direct equipotential bonding is established and the required surge protective devices are installed. In principle, all unshielded and unearthed cables must be protected by surge protective devices. The low-voltage supply of the roadside controller is protected by a lightning current carrying combined arrester. The information technology cables of the roadside controller are typically connected to the traffic control centre via optical fibre cables. In this context, it must be observed that only both ends of their metal sheaths are connected to the equipotential bonding system.

IN MEMORIAM

1942 - 2015

Michael (Mike) Frank Hadingham

Mike passed away after a short illness on 1 September 2015, shortly before his 73rd birthday. Mike had been an active working pensioner up to 2 weeks before his passing and he will be sorely missed.

BY | RON CONEY | FSAIEE

Mike was born in England during the second world war (10 October 1942) in the town of Harleston. He was quickly evacuated to the country as a result of the bombing of nearby buildings with V1 rockets.

Mike first met his father, who had been posted to Africa during the war, when he was two and half years old.

He went to Ditchingham Primary School and then the Sir John Leman grammar school in Beccles. Mike was an enthusiastic sailor (a passion he followed in Boksburg after coming to South Africa) and learned to glide whilst at school passing his glider pilot exams at the extraordinary age of 16.

Like all true engineers he had a passion for building and restoring things ranging from a mirror dinghy to the BSA Beezer 250cc twin motorbike he rode to university and later an old Rover 14.

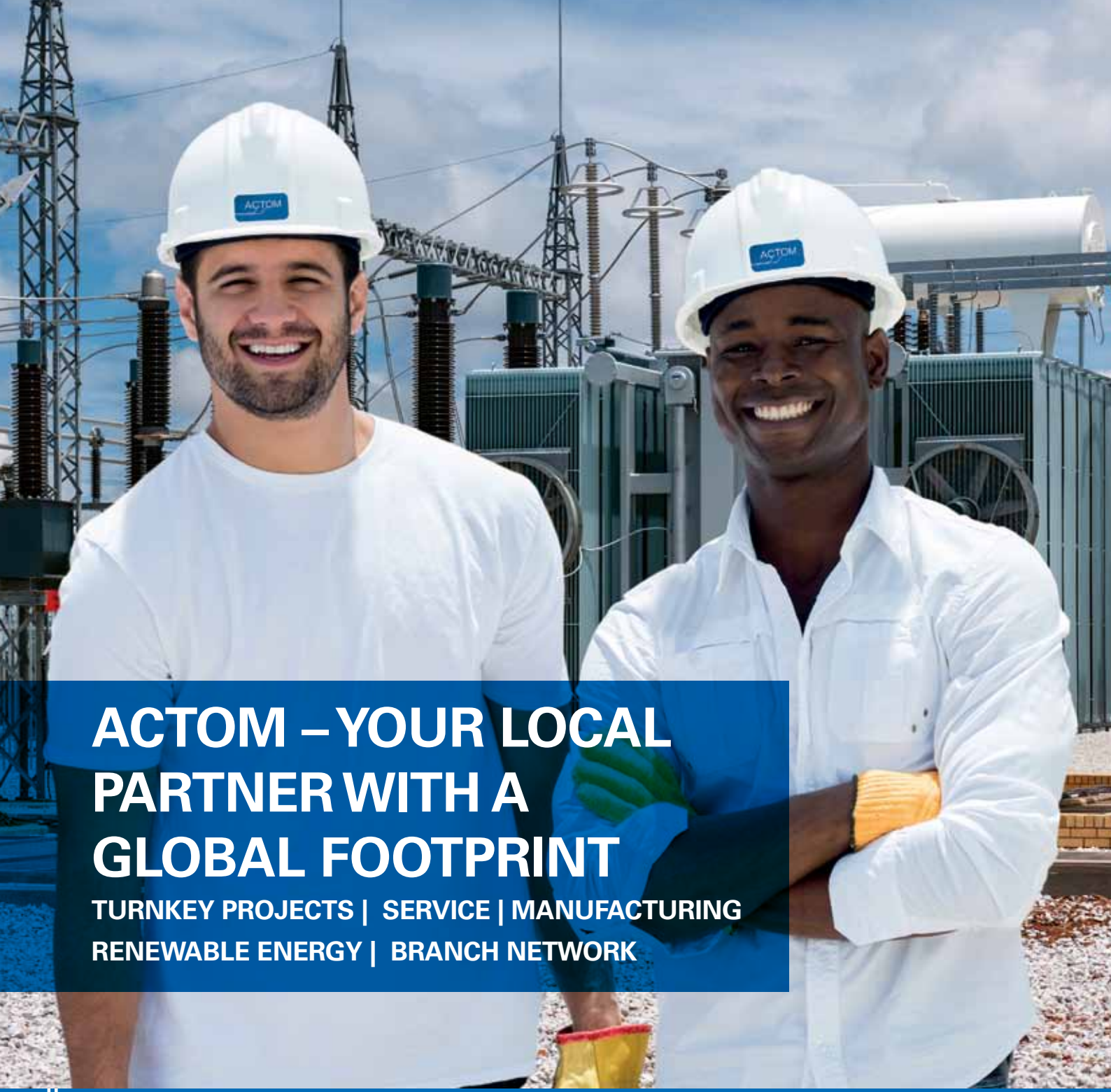
Mike graduated from the London University (Stafford) in 1966 with a B.Sc. (Eng.) Power Engineering. He then attended the Staffordshire College of Technology where he gained a Higher National Certificate in Mathematics in 1967. He completed a UNISA MDP in 1990. Mike was a Registered Professional Engineer in South Africa, Chartered Engineer (UK) and a Senior Member of the SAIEE. He published some 8 technical papers nationally and internationally during his career as well as many more within Eskom and the local industry.

He started working for English Electric in Stafford from 1966 until 1970. Mike then joined Eskom in 1970, as an electrical engineer, pursuing a long and distinguished career until retiring in 2008. Retirement did not slow Mike down and he joined EON Consulting in Midrand 2008-2011 and moved to Hatch in 2011 where he worked actively until his untimely demise.

During Mike's career with Eskom he was promoted from Engineer to Senior Engineer System Planning (1975) and Chief Engineer System Planning (1980). Mikes career in system planning included appointments at chief engineer level in special projects, transmission utilization and operations planning. He was well known in the SAPP utilities throughout Southern Africa and his name won competitive assignments for his employers subsequent to Eskom. Mike, a true gentleman was a dedicated mentor to his younger colleagues with whom he unstintingly shared his knowledge and wisdom.

Mike is survived by two sisters, Penny and Bridget, a brother Jeremy, his wife Rhoda who he met and married in South Africa and their two children Jenny and Tim and his grandchildren Cailin, Andrew and Ziningi.

Kwaheri Bwana Mike, Hamba kahle!!



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WATTSUP

Previously disadvantaged schools to get SeeBox to study electronics thanks to Social Media Campaign!

Having been one of the Innovation Prize for Africa (IPA) finalists held in Morocco in May this year, Johann Kok the inventor of The Scientific Engineering Education Box (SeeBox) is a very busy yet happy man. The SeeBox recently won 3 of the 5 categories at the SA Innovation Summit held in Cape Town. Johann won the PwC Pitching Den competition for Startups, the SAB Foundation Best Social Invention category and the Standard Bank Incubation Program category.

The SeeBox Indiegogo crowd funding campaign launched with a thunderous start and Johann is hoping that the interest of the 1st few days only grows, so that the campaign will deliver 100 SeeBoxes into 100 different schools.

Johann says *"Research shows that there is a current worldwide shortage of electrical engineers and this shortage will worsen in the future. Yet in spite of knowing these facts, little is being invested to change this trend. This inspired the creation of the SeeBox."*

"It has been shown that a young child learns new skills much easier than an adult. So it makes sense to teach people to think in a problem-solving way, like an engineer needs to think, at a young age!" Says Johann.

SeeBox seeks to address the worldwide shortage of engineers by introducing learners to electronics at a young age. Africa lags behind in the training of engineers and the SeeBox offers a technological solution to this.

SeeBox is a game console that teaches electronic principles, problem solving and abstract thinking to learners, tertiary students and even children at home, without needing an electronics teacher. Learners watch entertaining animated videos to learn about the concepts of electronics. They then use that knowledge to progress through a "game". Each level is a practical electronic experiment using real electronic components and experiment boards, called Playboards, while SeeBox measures the outcome of the experiment and, based on what the learner achieves, they can proceed to the next level.

SeeBox is also a sophisticated test instrument for professional electronic engineers to use, consisting of the 6 most often used instruments in one, and can be expanded to also include a multimeter, power data logging and more.

With the Indiegogo campaign, one has the opportunity to pre-order a SeeBox at a 40% discount. You also have the option to donate towards SeeBoxes for disadvantaged schools, or co-sponsor a SeeBox for any school you nominate. Invite your friends to also contribute. When 10 people contribute, K Measure will give a SeeBox to your school for free.

2015 Young Researcher Award Winner

Darryn Cornish, Lecturer at Wits University, was awarded the 2015 Young Researcher Award at the International Symposium on High Voltage Engineering (ISH) held in Pilsen, Czech Republic.

His paper and presentation title, *'Investigating the effects of nanoparticles on the electric field in dielectric material'* was a sure winner. *"This of course is a 'cakeable offence'"*, said Dr Cuthbert Nyamupangedengu, Senior Lecturer, Wits University.

He added: *"We congratulate Darryn for his sterling work of placing Wits on the 'world map' of HV Engineering; and no doubt this contributes to the University's vision of striving to be among the big league in research. We take this opportunity to thank Prof. Takawira for making it possible to send Wits participants to the ISH this year".*

Darryn Cornish

Master Power saves R9 000 per month with solar energy installation

Master Power Technologies (MPT) has taken its first step into the world of sustainable energy production with a R475,000 solar panel installation at its head office in Randburg.

Known for its energy-efficient solutions providing customers with reliable independent power systems, MPT has been researching the efficacy of solar power for some time. *"Having done our homework, we decided that implementing a solar solution at our own office would be the best way to demonstrate to clients that we were capable of recommending and installing solar solutions for them,"* says Master Power CEO, Menno Parsons.

The goal of the solar project was to design and install a renewable energy system to supplement MPT's power usage and reduce the company's electrical costs, while investigating solar power generation as an efficient means of renewable energy.

"With growing electricity costs and an increasing number of power outages, research into practical and efficient solar installations that provide decreased long-term electricity costs and offer a sustainable energy source was critical to Master Power," adds Parsons *"In addition, an efficient system would decrease MPT's demand on the South African electricity grid while supplementing our backup power solutions in the event of a power outage."*

The solution Master Power designed was installed on top of the car ports in the parking lot. Each of the two parking bays has 80 x 250 watt PV panels coupled to a 20kW inverter, totalling 40kW potential power in ideal solar conditions. The solar panels occupy a total area of 600m^2 and are perfectly suited for a rooftop installation.

The total cost of the system including all the necessary cabling and mounting equipment was R475,000. Therefore, producing an average of 150KWh per day, the system has an expected pay back period of 4 years and 4 months in terms of savings from reduced electricity costs. Clarifying the savings MPT will achieve, Parsons says that an average of 150KWh per day translates into an average saving of R9000 per month with current electricity tariffs.

However, he notes that with Eskom asking for another 25% increase in its fees, the payback period will actually be far less. *"In addition, we haven't even included the cost benefits of having our own green power supply that does not depend on diesel or petrol and allows employees to remain productive during periods of load shedding."*

The solar PV system is a once-off cost with a maintenance life of 25 years, which in the long run will provide significant savings. Not only is it economically beneficial, but it is an environmentally friendly means of obtaining an alternative energy source.

The solar project took approximately 2 months to install. As this was a first for the MPT team, depending on the site, future installations should be conducted in a shorter period.

Master Powers customers can also benefit from similar solutions which will help them achieve improved environmental status through green energy solutions, limit the demand on the South African grid and save not only electricity charges from Eskom, but also on current costs of running backup solutions during power outages.

Kings School Win 2015 UJ-Unitronics Weather Station Design Challenge

The Kings School West Rand was for the second year announced overall winners of the UJ-Unitronics Weather Station Design Challenge at TechnoLab, University of Johannesburg (UJ) at the weekend. The challenge included the participation of Hoërskool Florida and Deutsche Internationale Schule Johannesburg.

ead of School: Electrical Engineering, Prof Johan Meyer said: *"The challenge, in partnership with Unitronics, is geared to expand the learner's knowledge of engineering and technology, in addition it creates a platform that encourages social cohesion, promotes interpersonal skills and team building. Congratulations to Kings School West Rand for winning the challenge and walking away with the Best Construction Award."*

Deutsche Internationale Schule Johannesburg impressed judges with their low cost model which utilised recycled material with the total expenditure amounting to R8.00. For their out-of-the-box approach, the team won the Most Innovative Award. The competition between the teams were very close, however, Hoërskool Florida won the awards for Most Data Captured and Best Functionality.

UJ-Unitronics Project Co-ordinator, Johan Venter said: *"Learners were tasked to solve real world problems using industrial equipment and components. The weather station concept supports school STEM curriculum and focuses on safety, design, construction and operation. Each project was required to incorporate the use of Unitronics Programmable Logic Controllers (PLC). Excessive spending on the project was not permitted."*

The partnership with Unitronics provides a platform for industry and learners to collaborate. Over the last two years, Unitronics has been one of the School of Electrical Engineering's partners of choice with 26 years of experience in design, development and production of industrial electronic products. Unitronics automation products comply with UL certification standards and are designed to make automation simple, efficient and cost-effective. PLCs are computer-based electronic products which serve for the management, control and automatic operation

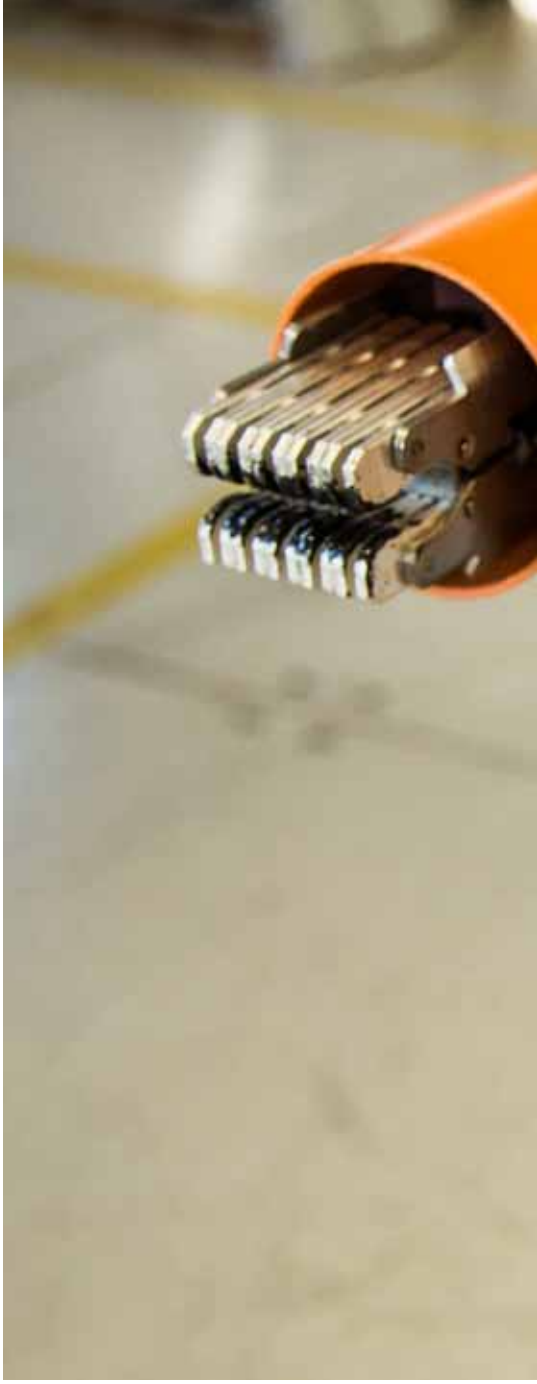
of electromechanical processes, machines, production lines and other automated applications in many industries.

Venter said: *"The UJ-Unitronics challenge exposes leaners to opportunities within the field of electrical engineering and how simple technological innovations can be used to measure real weather parameters, incorporate weather storage data, display data and computed parameters with time and geographical information. Beyond mere development of the weather station, teams are required to present on data collected over a 14 day period."*

The 2015 panel of judges included South African Institute of Electrical Engineers (SAIEE) President, André Hoffman; School of Electrical Engineering Associate Professor, Prof Yanxia Sun and Postgraduate Student, Anthony Gaskell from the Carl and Emily Fuchs Institute of Microelectronics at University of Pretoria.

Participating teams were issued with Citek Digital Multimeters sponsored by Coral-I Solutions, and the overall winners received an AfrikaBot starter kit to compete in the 2016 AfrikaBot challenge. wn

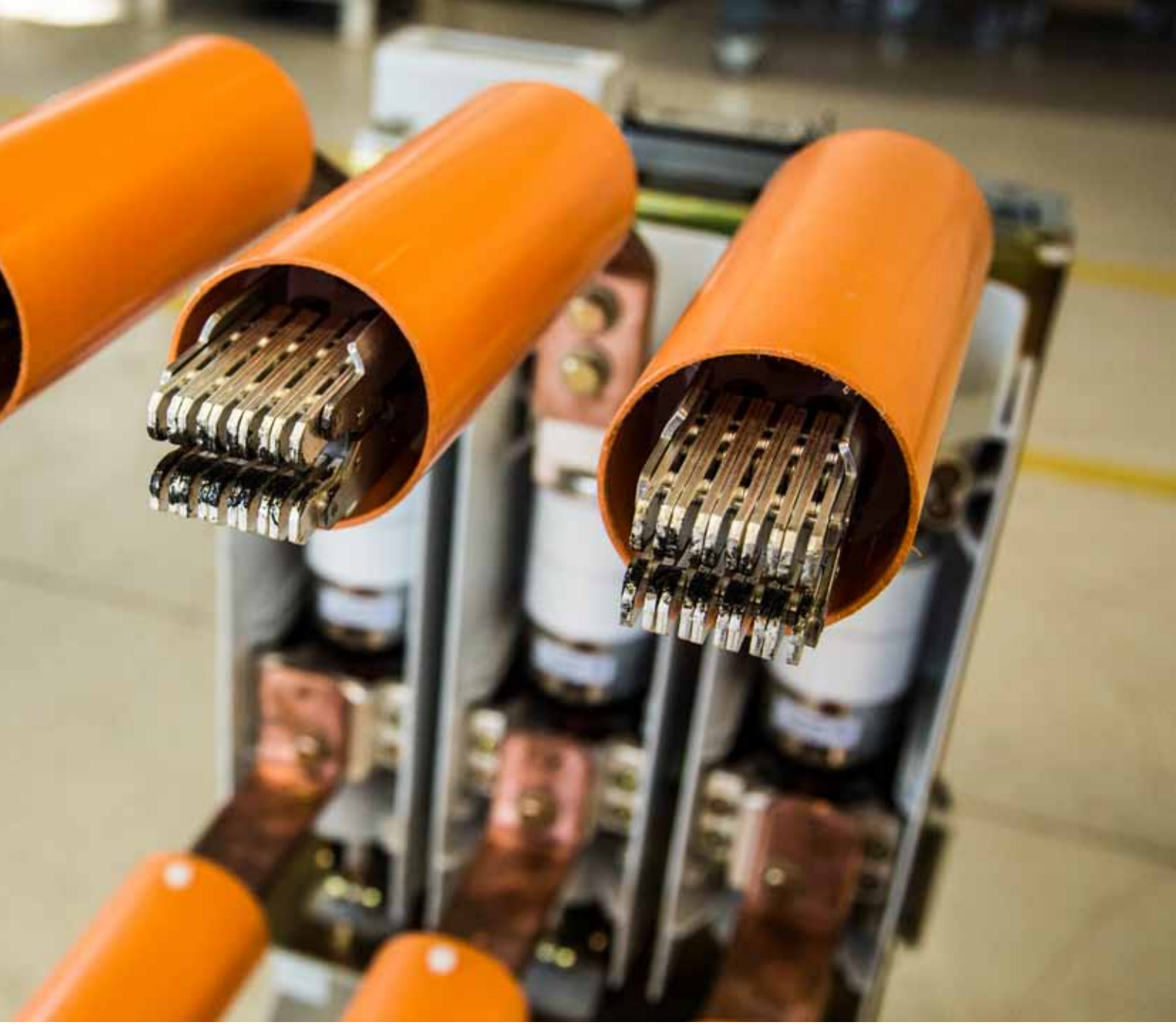
First locally manufactured Switchgear produced



Voltex MV/LV Solutions has been a Siemens Technology Partner for the 8PT and S8 ranges of LV Switchgear for the last 15 months (since 1st March 2014) and on the strength of this partnership the Directors felt the time was right to expand the agreement with Siemens to include manufacturing LV Switchgear.

This extended license agreement will enable Voltex MV/LV Solutions to offer a full solution to the client from MV through to LV in the growing medium voltage market. In addition, it offered the perfect opportunity to develop local skills in the manufacture of MV Switchgear and technological expertise to Siemens standards. The three employees chosen to go for the partnership training were Luca Petersen, Damien Buchanan and Neil Stewart.

The training took place at the Siemens production facility in Getze, near Istanbul in Turkey, where they learnt the design, manufacturing, assembly and testing of the Simoprime MV Switchgear. This range of air-insulated, metal enclosed, metal clad medium voltage switchgear is for indoor installation with maximum ratings of 17.5kV/40kA/3600A. The product range includes circuit breaker panels (incoming and outgoing), metering, disconnecting bus-coupler and bus riser panels from 7.2kV to 17.5kV with vacuum contractor panels in 7.2kV and 12kV. Available panel widths are 435, 600 and 800mm at a depth of 1860mm. Commenting on the



level of training, Luca Petersen stated "the training quality at the Siemens facility was exceptionally high and being able to bring back these new skills to be used locally is enormously rewarding."

Vacuum interrupters are a highly proven and widely used technology, having 64% of the world market share when it comes to medium voltage switching. Simoprime uses the Siemens Sion 3AE5 and 3AE1 vacuum circuit breakers which range from 7.2kV to 24kV and are suitable for both withdrawal and fixed mounting arrangements within the panels. Operations also take place behind an interlocked closed front door, giving the customer complete peace of mind knowing that the operator will be safe and that the switchboard fulfills all the mandatory type tests required for the new IEC 62271-200.

The first Simoprime order was placed in December 2014 by Consulting Engineers Bosch Projects comprising of 16 panels for Sumitomo Rubber in Ladysmith. The first 4 panels were for an upgrade to their 3.3kV pump house board; these were delivered to site in April. The remaining 12 panels commissioned, replaced their existing 11kV sub-station 1 main intake board and were delivered in May. The next MV project currently in production has been commissioned for Tanelec in Zambia.

Voltex MV/LV Solutions was established in 2003 and integrated into the Voltex Group in 2014. Voltex MV/LV Solutions provides tailor-made manufacturing products and services, which are directly sold to the end user. It has a central focus in the production of LV/MV Panels and Switchgear, Variable Speed Drives, Motor Control Centres, Distribution Boards, Mini-Subs, Standby Generators and Specialised Assemblies. All products and services are IEC and SABS certified and tailored specifically for end users. wn

SAIEE Smart Grid Conference 2016

The South African Institute of Electrical Engineers will be hosting a Smart Grid Conference on 23rd to 25th February 2016, at the Eskom Academy of Learning in Midrand Johannesburg. The Conference will provide a platform for industry to discuss cutting edge innovations in smart grid and it's associated technologies; including addressing how the current electricity network can be converted into a smart grid. It is strongly believed that the adoption of smart grid technology within Sub Saharan Africa will provide immense benefit to the delivery of electrical energy in this Region.

he Conference will include keynote addresses, plenary presentations and panel discussions, as well as paper presentations in two simultaneous tracks.

An impressive list of international experts in the area of smart grids have been lined up for the Conference, and include the following:

PROFESSOR MASSOUD AMIN

Professor Amin is regarded as the "father of smart grids", and leads a number of extensive projects in smart grid research. Since 2003 he has served as Director of the Technological Leadership Institute at the University of Minnesota, and occupies the Honeywell/H.W. Sweatt Chair in Technology Leadership at the same University. He is also Professor of Electrical and Computer Engineering.

Prior to joining the University of Minnesota in 2003, Professor Amin held senior positions within the Electric Power Research Institute (EPRI) in Palo Alto. It was during this period that he conceived and articulated the vision of a smart self-healing grid. This is where the use of computer, communication, sensing and control technologies operate in parallel with an electric power grid to enhance reliability, increase resilience and reduce the cost of energy to consumers.

In addition to his technical leadership activities, Professor Amin maintains an active research program and has made significant contributions in predictive system identification methods, coupled with analytical and multi-domain modelling, fast simulation optimization and testing methodologies. All of these he applies to complex and large dynamical systems. Since 2003, he has given four briefings at the White House and nine Congressional briefings on smart grids. He has also served on numerous occasions as the USA delegation representative to several world engineering

SmartGrid

ENABLING INTELLIGENT ELECTRICAL POWER SUPPLY AND DEMAND BALANCING

CONFERENCE

and scientific congresses. He is regularly interviewed by the media including the New York Times, CNN, BBC, Washington Post and Wall Street Journal to name a few. One of Professor Amin's key area of interest is how to revitalize ageing grids and he has delivered a number of talks in this regard, including a TED presentation.

Professor Amin currently serves as Chairman of the IEEE Smart Grid Committee and also serves on the IEEE Control Systems Technical Committee on Smart Grids. He is the founding chairman of the IEEE Smart Grid Newsletter.

MR KURT E. YEAGER

Mr. Yeager, who has over 30 years of experience in the energy industry, was previously President and Chief Executive Officer of the Electric Power Research Institute (EPRI). Currently Mr. Yeager is Vice Chairman of the Galvin Electricity Initiative, which is a non-profit organization that he co-founded with Robert Galvin, after retiring from the EPRI. Mr. Yeager is also Vice Chairman of the Galvin Electricity Initiatives Perfect Power Institute which is focused on transforming the reliability and value of the USA's electricity services.

Mr. Yeager has authored over 200 technical papers and publications on energy and environmental topics, including a book entitled Perfect Power which he co-authored with Robert Galvin. He was also a convening lead author for the International Institute of Applied Systems Analysis (IIASA) "Global Energy Assessment" report to the United Nations and World Bank.

MR LEE STOGNER

Mr. Stogner is the President of the Vincula Group, a consultancy in the USA that specializes in the Internet of Things. He has over 30 years of design, consulting, project management and business development experience across a range of industries, including companies such as Digital Equipment, Fluor Corporation and Rockwell international.

Today Mr. Stogner is active in promoting the development of the Internet of Things through his participation in the IEEE Smart Grid Initiative, the IEEE Transportation Electrification Committee and as a member of the IEEE Internet of Things Initiative. wn

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A different type of grid is needed to solve SA's energy challenge

South Africa would get a much better return on its energy investments if it planned a smarter and more flexible electricity grid, according to Steve Hedden, Institute for Security Studies (ISS) researcher. A better grid would also boost the contribution of wind and solar energy.

overnment's response to power shortages and load-shedding has been a thrust towards more power generation from coal-fired power plants, oil and gas, renewables, and potentially a fleet of new nuclear power stations.

"But fixing South Africa's energy crisis is not just about generating more energy," Hedden said at the Pretoria launch of a new research paper called Gridlocked. *"It doesn't make sense to invest heavily in generation capacity without also rethinking transmission and distribution."*

Energy planning in South Africa has neglected the key element of how electricity moves from generation to consumption, Hedden said.

The Integrated Resource Plan for Electricity 2010–2030 (IRP 2010), adopted in March 2011, did not address the grid at all, though transmission was included in an IRP update in November 2013.
"Grid planning can't be an afterthought. It has to be built in from the start," Hedden said.

Planning the grid was much easier when a few big power stations provided energy mostly to a few big cities, with one organisation responsible for the entire system. In South Africa it was Eskom producing electricity at coal-fired power plants in Mpumalanga, the largest net supplier, and delivering most of it to the economic heartland of Gauteng, the largest net consumer.

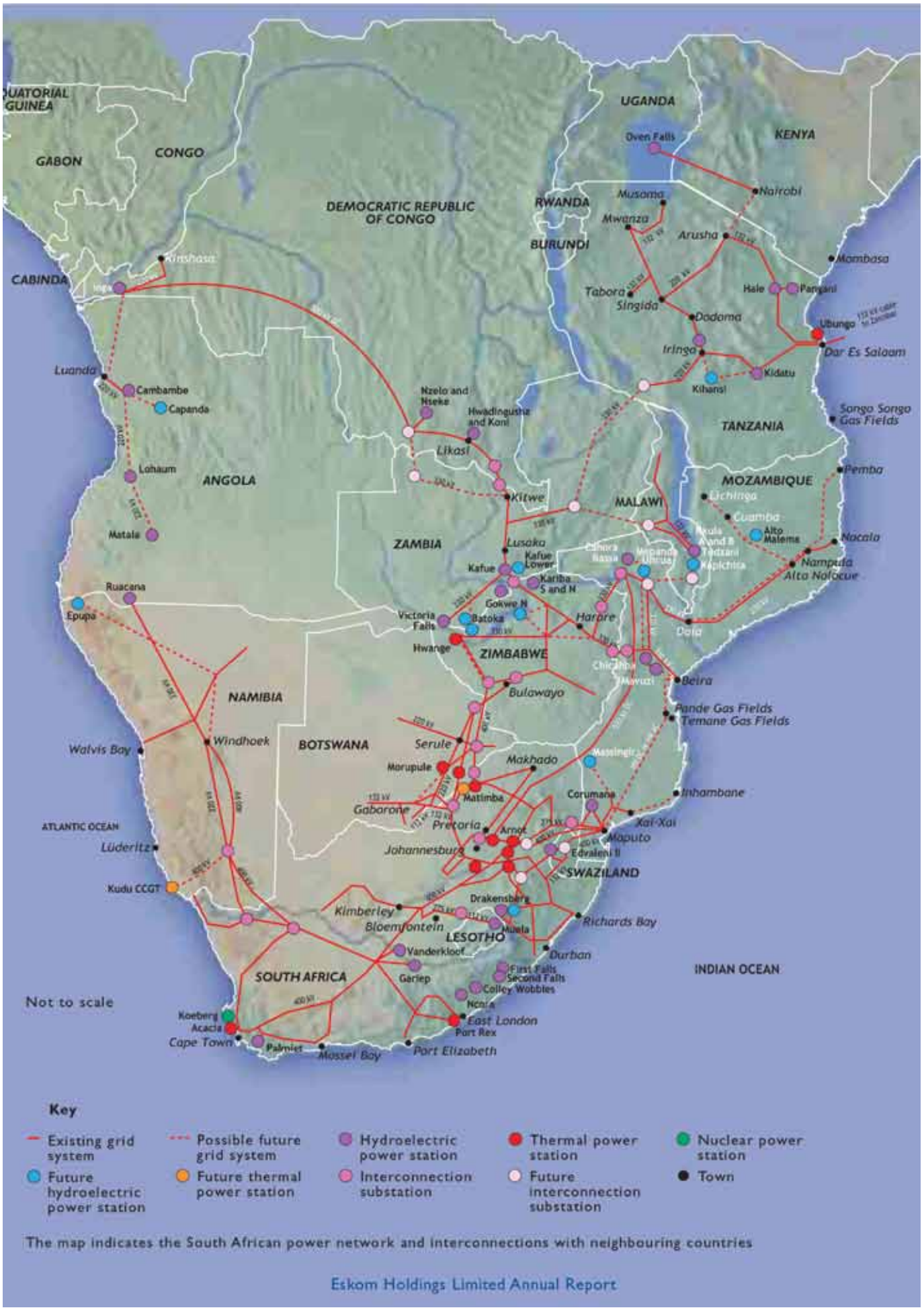
The source of power is shifting. By 2040, Limpopo's new coal-fired plants will make it the largest net supplier; and new gas and renewable capacity will make the three Cape provinces net producers.

Planners must also now consider the rise of renewable energy, and the addition of independent power producers (IPP). On top of this is small-scale residential generation as frustrated citizens install their own rooftop solar panels.

Electricity generation is thus becoming decentralised and intermittent, with the line between consumer and producer is blurring, Hedden said. At the same time, the electricity sector is transitioning away from a centralised monopolistic model as new players are taking on roles and responsibilities historically controlled by Eskom. The grid used to handle only a one-way flow of power from producer to consumer. Now it has to accommodate potentially millions of small-scale producers feeding energy into the grid.

Small-scale residential power generation from solar panels could account for 30 GW of electricity-generating capacity in South Africa by 2050, but its contribution today is retarded by an absence of clear policies and regulation.

"A more intelligent grid would be the result of investments in grid efficiency, and better electricity planning, operations and policies," Hedden said. wn



The map indicates the South African power network and interconnections with neighbouring countries

Eskom Holdings Limited Annual Report

64TH DR BERNARD PRICE MEMORIAL LECTURE

Earn CPD Credits

Sustainable Engineering Education

The landscape of higher education, particularly engineering education, is changing globally. Changes are brought about by the rising cost of higher education, newer technologies and a number of global trends. Global trends include changing expectations of "Generation-C" scholars, urbanisation, the need for sustainable development, changes in demographics and others.

The changing and challenging expectations create a number of opportunities for engineering education and its alignment to expectations of society today and tomorrow, including various players – industry, government and professional societies.

The 2015 Bernard Price Lecture summarised the global trends, undertaking a comparison of the proactive approaches taken by a number of globally leading higher education institutions, collaborative technologies, the status of engineering education in South Africa, the questions emerging from these trends and proposed a way forward.

BY | PROF SAURABH SINHA
PR ENG | PHD (ENG) | FSAIEE | FSAAE | SMIEEE

SUMMARY OF TALK

Acknowledging the achievement of the Millennium Development Goals (MDGs), over the weekend of 25 September 2015, in New York, the United Nations Conference on Sustainable Development adopted: *"Transforming our world: The 2030 Agenda for Sustainable Development."*

Sustainable development integrates the "ecosystem" constituting people, planet, peace, prosperity and partnerships (the five Ps). Seventeen Sustainable Development Goals (SDGs) were adopted, ranging from "no poverty", "quality education", "gender equality" and "clean water and sanitation" to "partnerships for the goals."

The achievements of the MDGs included – significantly – halving the world's population living in extreme poverty and halving the world's population living without sustainable access to safe drinking water and basic sanitation.

It is notable that the MDGs refer to "halving" (50%) goals; SDGs are much more challenging: they refer to reaching all – i.e. 100% of the world's population. This move from 50% to 100% will, along the way, introduce the challenge of the

Sustainable Engineering Education

continues from page 29

"last mile"[2] (say the last 20%): The "last mile" challenge is achievable, but traditionally requires an "infinite" budget – this is, by default, however, unachievable! Furthermore, attainment of the SDGs will rely heavily on the skills of engineers, engineering technicians, technologists and built environment professionals. Capacity development is therefore required. The lecture points out that emerging economies, such as countries in Africa, require at least a tenfold increase in relevant skills; at the same time the skills need to be developed at the "fast-paced" private or public-sector requirements. Unlike in the past, there tends to be no time for graduate-in-training or candidacy-oriented mentorship.

In the geography of such emerging economies, a number of factors complicate technical sectorial growth: brain drain, the pipeline of prospective students and low throughput.

Of over 500 000 students registered for programmes in the various engineering, engineering technology and the built environment, during 1998-2010, approximately 15% graduated.

This challenge continues today.

In 2011, ECSA produced a throughput report, but its recommendations have yet to be implemented. One recommendation proposed curriculum change.

Sustainable Engineering Education (SEE) acknowledges that;

- much is known about curricula and andragogy today (the learnings of this education discipline have yet to be implemented in engineering education);
- using the understanding of how individuals today learn will improve throughput, eg. (Generation-Y (Gen-Y) is interested in learning through "active learning");
- the creative implementation of pedagogical practices will improve throughput. SDGs could effectively be included during this process and will provide the creativity desired by students today.

Among others, the curricular framework for SEE at all tertiary levels of the National Qualification Framework (NQF) should include society, environment and economics. Formal credits for pedagogy lending itself to such a delivery model could include the approach of Engineering Projects In Community Service (EPICS).

EPICS, which was initiated in the 1990s, by Purdue University, has been expanded by IEEE in over 15 countries [1]; the EPICS-in-IEEE approach includes a partnership between non-profit organisations (NPOs), communities, secondary schools and universities. Non-Profit Organisations (NPOs) already serve communities. However, they lack the technological edge that universities/Gen-Y students could supply. At the same time, by engaging pre-university groups, the pipeline of prospective students could be inspired.

An EPICS-in-IEEE example is a mobile phone based system that addresses air or water quality; this initiative realises SDGs #6 – clean water and sanitation and #13 – climate action. Through Project-Based Learning (PBL), students are exposed to the five Ps and SEE.

Various levels of the NQF would engage differently - at undergraduate level, students would take an off-the-shelf systems approach, whereas those at more senior undergraduate levels, or early postgraduate levels, would benefit from learning at more fundamental levels of implementation.

SEE relies on combining bottom-top based learning with top-bottom interest and inspiring learning, as per the quest of Gen-Y. While the framework would challenge tight administration, such as timetabling, the approach would contribute to improve learning and, most likely, throughput; Gen-Y is interested in improving societies through technology. However, traditional delivery of curricula takes a bottom-up approach; students are "lost" by this convention. The challenge is not unique to South African engineering education, but is experienced globally.

Globally "top" universities are, however, moving towards interdisciplinary PBL. PBL is geographically contextualised, fast-tracking local relevance, and at the same time fostering global competitiveness through, amongst others, professional society oriented partnerships.

Interdisciplinary PBL requires a new range of electives – ranging from ecotronics to biology – challenging the expectations of a traditional engineering programme, but at the same time adding to the much needed interdisciplinary creativity required to attain SDGs.

PBL delivery would need to be blended with modern technologies especially as much of core educational content is already available online. The blended approach expanding access to alternative contact sessions would ease administrative complexities. Gen-Y also overlaps with Generation-C (consumer culture orientation), thus e-learning and true m-learning is natural to this group.

Back to the "last mile" challenge:

increasingly the "last mile" in electrification is being resolved through "off-grid" renewable solutions. A similar decentralised approach may be necessary for reaching sustainable water goals. The hybrid approach could include buildings supporting rainwater harvesting, recycled water usage and localised water sources as opposed to transmission through centralised sources such as dams (or power stations, in the electrification analogy).

The penetration of mobile communications in rural parts of Africa shows that this possibility may be a solution and that the solutions could blend, favouring the SDGs.

The integration of economics requires SEE – thinking not only in terms of engineering units – such as kWh or litres of water, but in terms of rands or dollars per kWh or rands or dollars per litre of clean water.

The approach allows for an achievement recognising finite budget limitations.

SEE is therefore required for SDGs. SEE/SDGs could be the catalyst for much needed capacity development in emerging economies; the early integration of society, economics and environment would assist Gen-Y graduates to solve tomorrow's problems today. wn

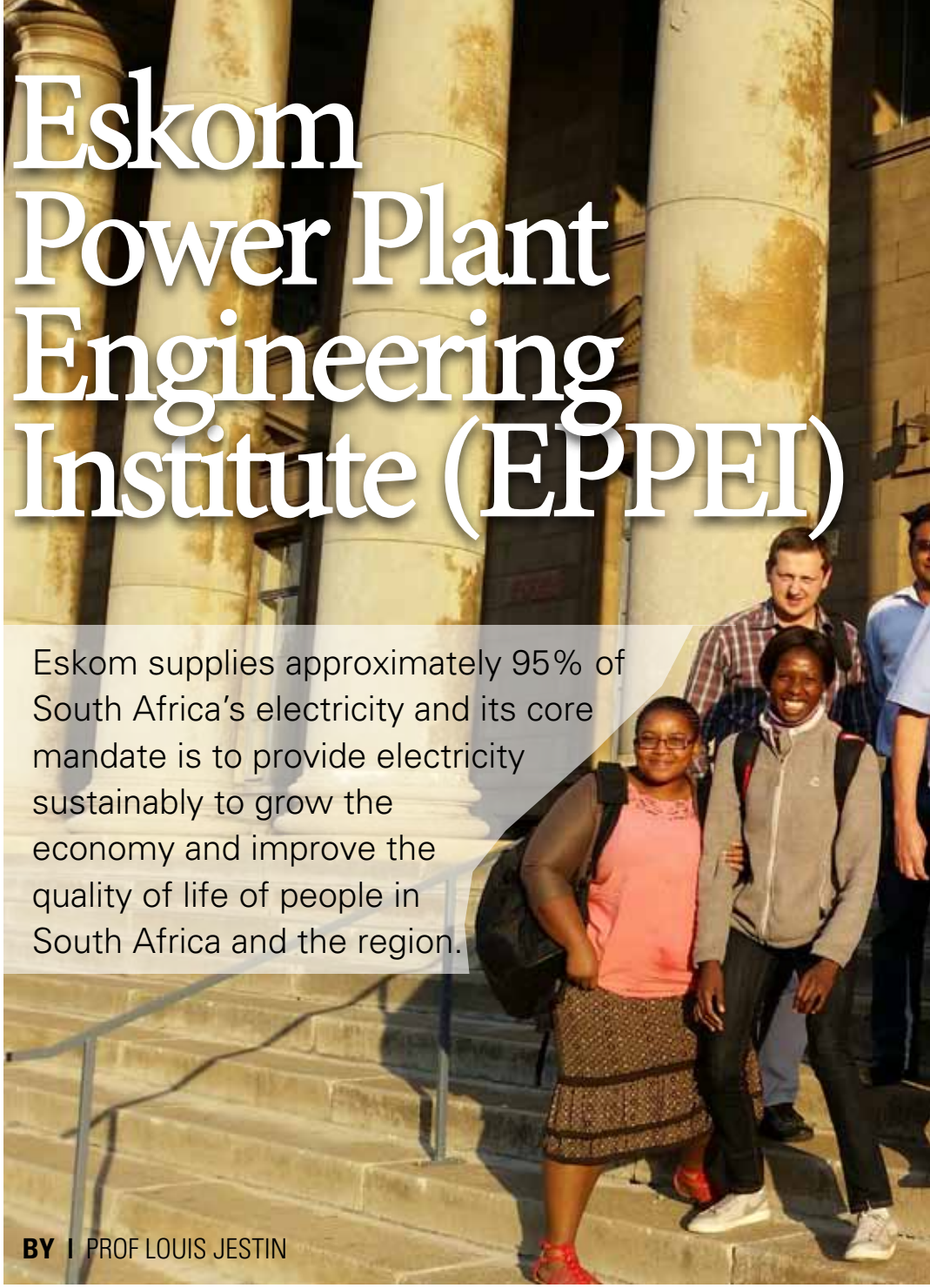
REFERENCE

[1] Dandekar, K.R.; Sinha, S.; Ampofo-Anti, N., "IEEE-Based Implementation of Engineering Projects in Community Service," in 2011 IEEE Global Humanitarian Technology Conference (GHTC), Seattle, Washington, USA, pp. 481-486, Oct. 30 2011 - Nov. 1 2011, doi: 10.1109/GHTC.2011.70.

[2] To borrow from telecommunications - 'last mile' refers to te technology that exists coming along short distances between home and office.

Earn CPD Credits

Eskom Power Plant Engineering Institute (EPPEI)

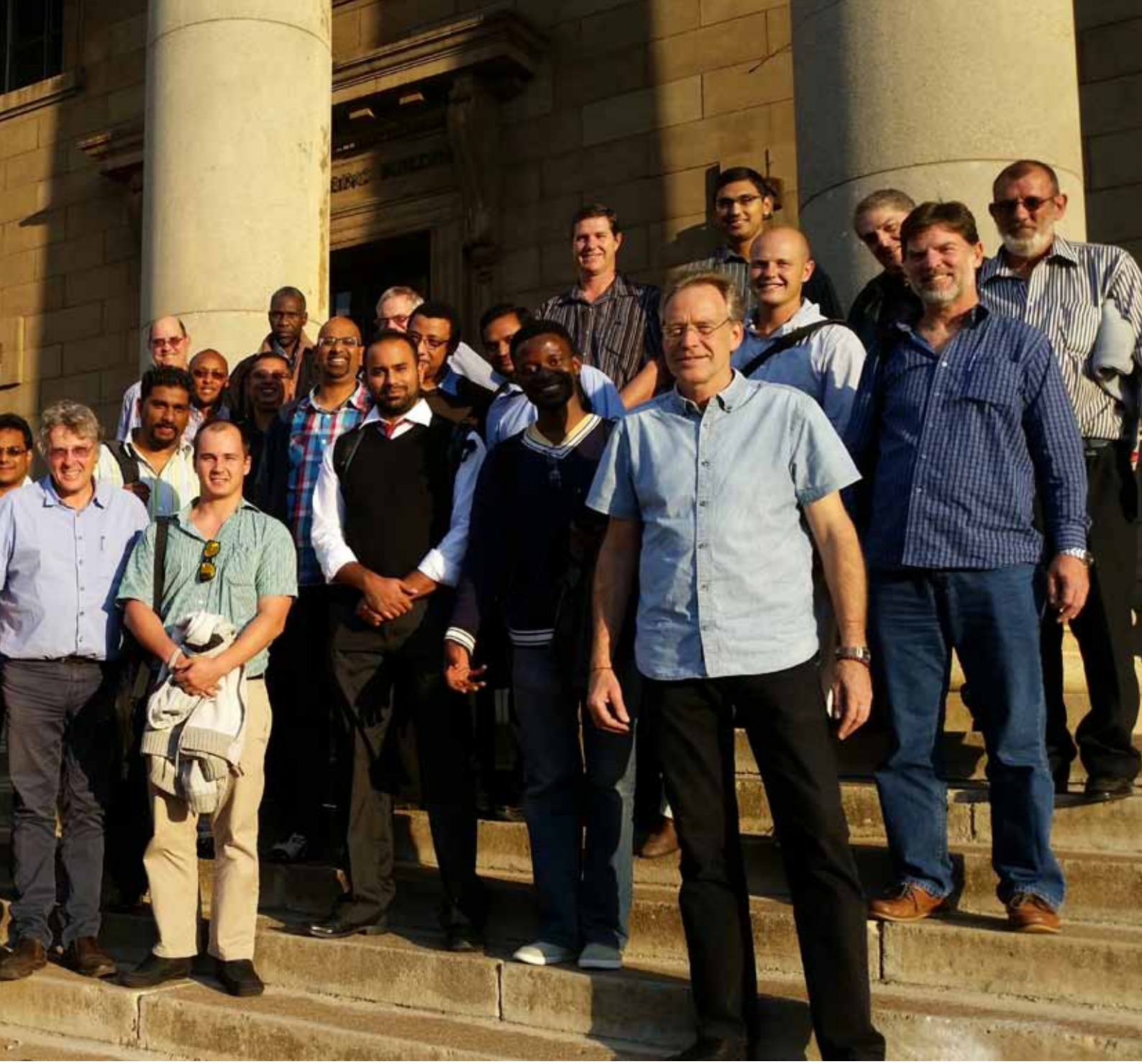


Eskom supplies approximately 95% of South Africa's electricity and its core mandate is to provide electricity sustainably to grow the economy and improve the quality of life of people in South Africa and the region.

BY | PROF LOUIS JESTIN

ts mandate also includes asset creation and maintaining operational and financial sustainability. In addition to this, as a strategic state-owned company, it is also expected to contribute to transformation, social and environmental sustainability and to building a sustainable skills base. From a technical point of view its power generation fleet is aging with an associated increase in planned and unplanned capacity loss factors and therefore its energy availability factor is falling well below the targeted value of 85%. This has highlighted a need to provide visible leadership, recover good practice and develop technical expertise.

Eskom's aging fleet and South Africa's increasing power demand has led to a lengthy and large expansion programme to extend the life of the existing fleet. This represents a unique opportunity for South Africa to develop a service industry around the power plant industry.



In view of this, and in support of government's goal in the National Development Plan (NDP) to transform South Africa to a knowledge based economy, Eskom established the Eskom Power Plant Engineering Institute (EPPEI) in 2012.

EPPEI's aim is to contribute to solving Eskom's technical challenges using a research-based methodology that develops deeper understanding and problem solving ability amongst its students, while at the same time advancing them to masters and doctoral degree levels.

At present EPPEI is made up of eight specialisation centres at six leading South African universities. The programme was designed to primarily accommodate Eskom employees as full-time postgraduate students and to leverage the synergies between the practical experience gained while working at Eskom and the expert input from academics. The current contracts between Eskom and the different universities are valid from 2012 up to and including 2016. EPPEI is managed by the Eskom Academy of Learning supported by an inter-university Co-ordination and Administration (C&A) structure. The insufficient number of qualified engineers that can serve the power sector as well as the perceived lack in university tutoring of relevant subjects were a strong motivation to establish the Eskom Power

EPPEI

continues from page 33

Plant Engineering Institute which started operation on 6 January 2012.

Eskom identified the following objectives for EPPEI:

1. Increase the number of power plant industry-focused postgraduate level (master's and doctoral) graduates within Eskom;
2. Ensure South African universities participate fully in the localisation of new technologies currently being offered to Eskom by Original Equipment Manufacturers (OEMs);
3. Ensure South African universities play an active role in transferring and establishing these new technologies in the country and to continue to develop and enhance this technology through further research and development;
4. Ensure South African universities are actively involved in solving Eskom specific engineering problems; and
5. Leverage the expertise and experience of international universities and utilities.

Since its inception, EPPEI has strived to meet these objectives and its value to trainees/employees, local universities and local industry has started to emerge. All eight specialisation centres, hosted at six lead universities, have been established according to the initial allocation plan where full time personnel have been enrolled. Partner universities have been identified by the lead universities and are now firmly integrated in the EPPEI structure.

The initiative has a far-reaching effect on research and tuition activities geared towards solving technical problems and building human capital for the power industry.

Aside from the establishment of specialisation centres at the lead universities, the EPPEI programme has created additional capacity at these universities. The appointment of professors and senior lecturers has led to an expansion of subjects taught and to the introduction of more power sector related undergraduate and postgraduate courses. It has also increased the capacity to supervise post graduate students, over and above the supervision of EPPEI students.

The "EPPEI community" consists of 159 people actively involved, with 49% of high academic calibre i.e. 35 professors and 43 PhDs. The split between full-time and part-time involvement is 23 to 136. The total number comprises of 65 academic supervisors (AS), 67 industrial mentors (IM) and committee members and 27 people forming management and support staff.

Besides lecturing capacity and the expansion of courses, the different centres have developed capabilities that can improve tuition and research. These include test facilities, computer labs and numerical modelling tools relating to:

- Steam Plant Simulation and Optimisation
- Coal Characterisation and Measurement
- Advanced Combustion Analysis Facility (CFD and FEA)
- Gas/Particulate Emissions Measurement Capability
- High Temperature Material Testing Facility
- Solar Measurement Facilities
- Testing and Reliability of Turbo Machines
- Advanced Grid Simulation Facility for Stability and Optimisation
- Power Quality Measurements

EPPEI is well on its way to fulfil all criteria that it was tasked or designed to achieve. It has become a recognised institute within Eskom as well as by local and international universities, along with well-recognised international power utilities and OEMs. The first two intakes of students have completed their research and are adding value to Eskom in the many different areas where they are employed. EPPEI has created a growing awareness of the importance of the power industry within many of the South African universities as well as the need for having more high level skilled engineers to tackle the many complex problems the power industry encompasses.

EPPEI has empowered the universities involved to develop research facilities in the critical areas needed to improve knowledge and develop tools as well as to offer relevant courses and degrees. EPPEI has attracted numerous collaboration partners, locally and internationally, who have shown interest in adding value to Eskom as a utility but also to local universities and industry serving the power sector. During the second phase of the EPPEI programme (2017 – 2021), the eight specialisation centres will remain part of the EPPEI initiative and will be further developed according to the research strategic plans. EPPEI will also be better integrated into the Eskom Academy of Learning (EAL) especially to ensure the complementarities of development of engineer, technologist and technician skills. The centres are committed to develop Eskom's tecnical humaan resources by increasing the number of powerplant industry-focused postgraduate level (master's and doctoral) graduates inside Eskom, in order to provide sustainable and affordable power generation in the future.

For the remainder and the extended funding period three major evolutions to the EPPEI structure and programme are being prepared:

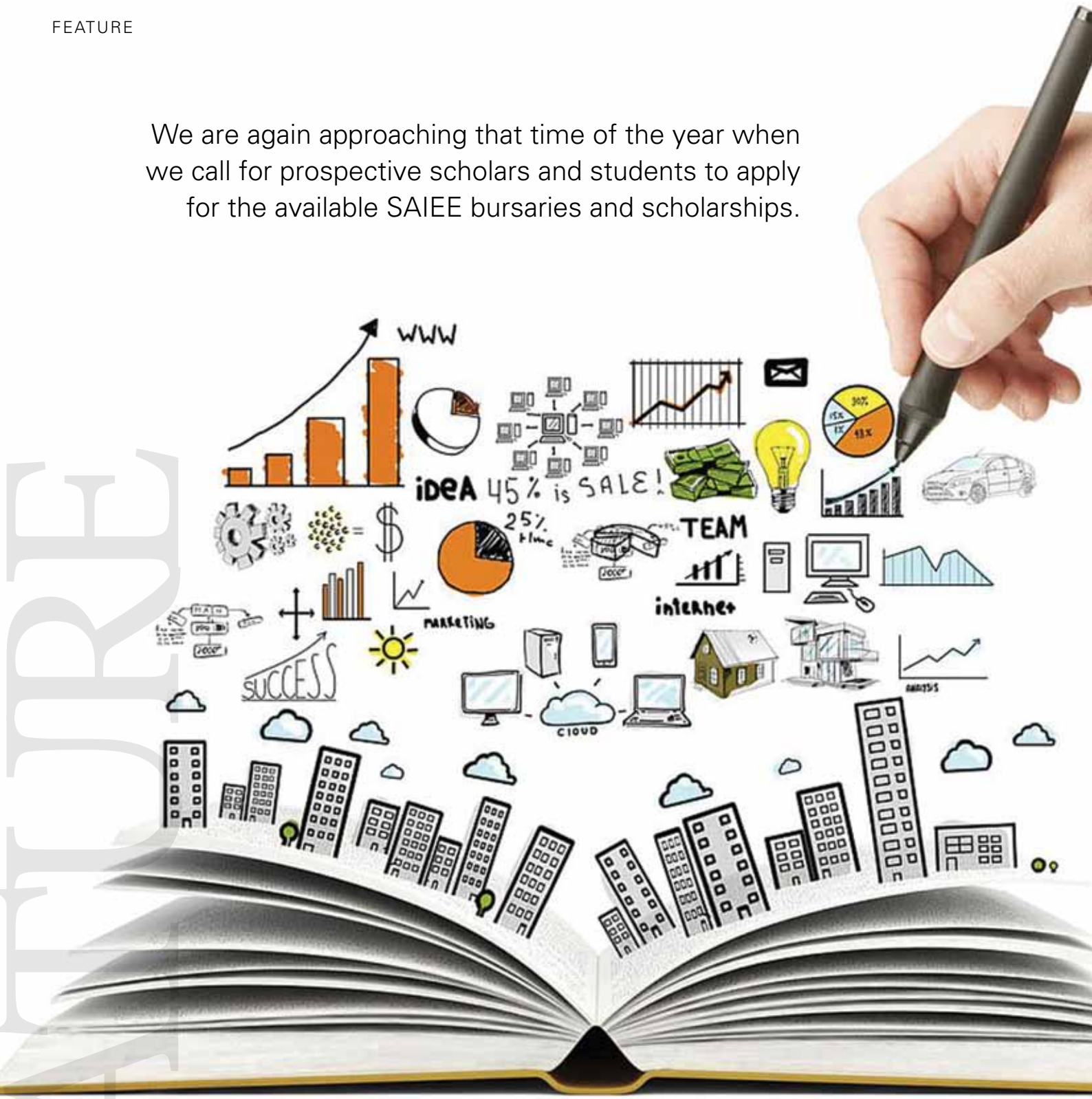
1. EPPEI course development and accreditation for various levels of qualification;
2. Definition and execution of large Inter-University Programmes (IUP) to address major technical challenges in Eskom; and
3. Establishment of an EPPEI Inter-University consortium.

The research underpins a power system-related university education in South Africa. As for the inter-university course curriculum discussed above, inter-university collaboration in research must be further developed to become the foundation of EPPEI's support of the South African power industry. Some collaboration has already been initiated between the EPPEI specialisation centres.

Rather than relying on isolated master's or PhD research, a formal structuring of the IUPs involving the different disciplines from the eight EPPEI specialisation centres and their stakeholders will be more efficient in reaching the overarching goal of EPPEI: addressing Eskom's power system needs through research.

Each of the programmes will be led by a specialisation centre which defines and manages the project. The main goal of the proposed IUPs is to generate the knowledge that Eskom and government need, through research, to make decisions necessary to manage a sustainable operation and development of the total power system. Three of the eight IUPs are specific to the discipline of electrical engineering: Smart grid; High Voltage Direct Current scheme performance; and Power System Simulation. The first three years of the EPPEI programme has allowed Eskom and the six universities involved to build a firm foundation of partnership between industry specialists and academia. The second phase, which has been approved by Eskom, presents opportunities to make improvements on the EPPEI model, whereby a new orginasational stuctire will be introduced.

We are again approaching that time of the year when we call for prospective scholars and students to apply for the available SAIEE bursaries and scholarships.



The SAIEE Bursary Scholarship and Loan Scheme

BY | HERMANN BROSCHK | FSAIEE

2014 was a successful year for our bursary scheme, as some of our bursars completed their degrees. These successful students were as follows:-

1. Mzomhlophe W Zakwe, Durban University of Technology;
2. Mzwanele Manana, Mangosuthu University of Technology;
3. Andre Jan Merts, Stellenbosch University; and
4. Connor Leonidas, Cape Town University.

The SAIEE bursars who passed their respective year in 2014 are as follows:-

1. Johannes Mostert, 3rd year, North West University;
2. Rudolf Byker 4th year, Stellenbosch University;
3. Wayne Dyamond 2nd year, Stellenbosch University;
4. Levashen Kuppan 2nd year, University of Kwa Zulu-Natal; and
5. Samuel de Bruyn 2nd year, University of Pretoria

If a student fails a subject, their bursaries will be cancelled, but this is not the end of the line. Once the subject(s) have been successfully completed and passed, the bursary will be reinstated.

Alternatively, they can apply for a loan from a bank which has the facility to provide loans to SAIEE students. The SAIEE loan scheme pays the interest applicable to the respective bank, and the students will be required to repay that loan.

All students who have a SAIEE bursary are contractually bound to become student members of the SAIEE from their second year and for the duration of their studies.

NEW BURSARS FOR 2015

New Bursaries have been awarded to the following students:

1. Nicojan Vermaak 3rd year University of North West
2. Cornelius Scheepers 1st year University of North West
3. Barnard Dreyer 2nd year University of Pretoria
4. Smangaliso Cwele, 1st year, Nelson Mandela Metropolitan University;
5. Ross Bawden, 1st year, University of Pretoria;
6. Marrene McDulling, 2nd year, University of Pretoria;

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7. Christoff Smith, 1st year, North West University; and
8. Rapha Pretorius, 2nd year, University of Stellenbosch.

The 5 existing bursary holders, together with the 8 new bursars, means a record number of 13 bursaries have been provided for 2015. In addition, all the candidates passed their respective 2015 mid-year examination - well done.

In 2015 the first SAIEE – ISH postgraduate scholarship was awarded to Mr Tatenda Gora of Wits University. Mr Tatenda Gora should complete his MSc degree at the beginning of 2016. A call for applications from postgraduate students interested in High Voltage Research has been made for 2016.

At the SAIEE council Meeting held in September 2015, it was tabled that the Past Presidents Forum will provide the necessary funding for a scholarship suitable for a student to study Electrical Engineering at a South African University in 2016. The scholarship will be known as the Past Presidents Premium Scholarship.

SAIEE advertises the bursary fund in a number of publications. The Bursary Register, which provides, and we quote "Everything you need to know about bursaries, scholarships and Loans available" to all Universities and Universities of Technologies.

In addition, SAIEE has an active website from which application forms can be downloaded.

SAIEE also works in collaboration with The Technical Research Activity Centre (TRAC) and The National Science and Technology Forum (NSTF). These bodies represent a large number of organisations and have an online bursary data facility which provides essential information on available SAIEE bursaries.

In addition SAIEE provides an administration service to companies/ Organisations who wish to provide students with bursaries, but who do not have the required administration facility for bursaries. This service is provided by SAIEE for a small fee.

We must not lose sight of the situation that once a student accepts a SAIEE bursary, SAIEE is bound by the contractual agreement to provide the bursary until the completion of the final year e.g. if a student is awarded a bursary, the SAIEE will have to provide financing for that student for 4 years, provided the student passes every year.

The number of bursaries in the "pipeline" thus limits the number of bursaries that can be awarded every year. wn

SHOULD YOU HAVE ANY QUERIES, OR REQUIRE AN APPLICATION FORM, PLEASE CONTACT:
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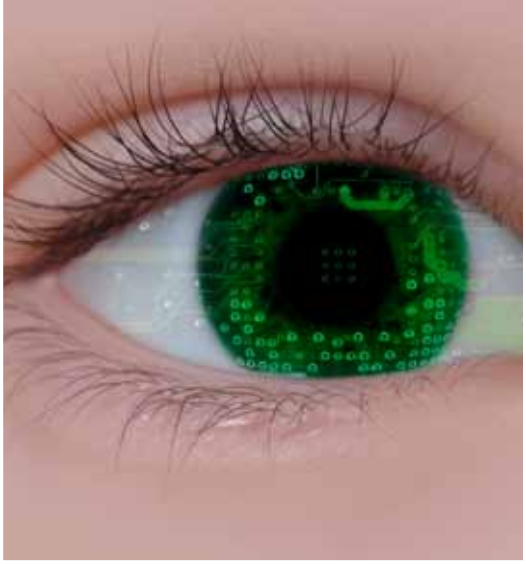

BFA IS DEDICATED TO PROVIDING A CONSULTING SERVICE THAT WILL BENEFIT ITS CLIENTS BY MEANS OF APPLYING THE LATEST TECHNOLOGY PARTICULARLY WITH RESPECT TO ENERGY SAVING, WITHOUT COMPROMISING THE AESTHETIC AND CORPORATE IMAGE OF THE CLIENT AT THE MOST ECONOMICAL COST.

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The fear is that the nuclear energy procurement process, for up to 9.6 GW of much needed baseload capacity, will see a scam perpetuated upon the people of South Africa that dwarfs the country's R30 billion arms deal debacle of 1999. This concern is exacerbated by the fact that nuclear energy is often an emotive and unpopular option, to be driven by a public sector which has failed South Africa badly in recent years.

The Politics of Nuclear Power in South Africa

The nearing of South Africa to the possible progression of a nuclear energy procurement deal has engendered significant alarm. This is reinforced by the idea of Vladimir Putin and Jacob Zuma conspire together.

BY | ANTONIO RUFFINI | MSAIEE

Even supporters of nuclear energy will have been halted in their tracks by claims out of Russia of a definitive contract having already been signed between that country and South Africa, bypassing due process and all transparency. Add to this the fact that Zuma has employed one of his loyalists in the form of Tina Joemat-Pettersson as Minister of Energy (who previously as Minister of Agriculture, Forestry and Fisheries was strongly associated with incompetence and corruption) and the scenario looks ugly indeed.

Perhaps a bit of perspective is necessary. There are three possible options for South Africa when it comes to the required baseload power to not only provide for economic expansion in the country and contribute to alleviating a shortage of power in the region, but to timeously replace ageing coal fired power stations. These options are coal-fired power, gas-fired power and nuclear. All have their pros and cons, as do all energy sources, and all are viable options.

South Africa has coal reserves, but the country is already very reliant on coal-fired power, and portfolio theory shows that diversification is prudent. This is particularly important if the climate change movement gains further momentum, accompanied by measures to penalise this usage.

Globaly, gas is increasingly going to take precedence over coal. A large scale gas sector in South Africa may evolve down the line. While the country is predicted to have great potential, thus far there are almost no proven reserves - and steps to prove such potential are likely to be slow based on current progress. For the foreseeable future gas usage would have to be through imports, and this would have an impact on balance of payments.

Nuclear is the third alternative, but it is less likely to be driven by the private sector than either of the other options. For completeness, the touted Grand Inga hydroelectric project in the Democratic Republic of the Congo (DRC) will be a great project one day, and provide much needed power to Africa. Such a project has been discussed for decades and this status quo is likely to continue. For South Africa to trust the unstable and distant DRC with its energy security at this point is a pipe dream.

In his State of the Nation Address on the 13th of February 2014, Zuma said that the South African government would undertake the procurement of 9.6 GW of nuclear power as part of the country's energy mix. This statement was based on the country's first integrated resource plan (IRP) that dates back to 2010.

This initial IRP was undertaken with the aid of the Electric Power Research Institute (EPRI) and was widely regarded as a well-thought out guideline for the future power capacity requirements of South Africa. It was asked to take into account a desire by the country to reduce carbon emissions without breaking the bank. From a global perspective, the politicised wisdom of targeting carbon

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emissions, versus opting for the lowest cost option (coal-fired generation in the case of South Africa), merits a lengthy discussion in its own right. The trade-off between possible risks of climate change associated with anthropogenic carbon emissions, versus likely lower economic growth and hundreds of millions of people around the world not being able to escape energy poverty, is a critical decision. South Africa too is influenced in its choices as a consequence.

It can be argued that the 2010 IRP upon which the nuclear procurement programme is based, is out of date. Unfortunately, as was feared might happen, the IRP, instead of being an illustrative and guiding document, became a prescriptive one. It gave the South African government the excuse to maintain that nothing could be done if it had not been included in the IRP planning. The government's desire for control, and to limit alternatives, is demonstrated by the implementation of a policy (enforced by the National Energy Regulator of South Africa (NERSA)), that the establishment of new generation capacity (other than for own use without transmission off one's property) can be done only with the energy minister's permission.

The IRP was updated in 2013. However, this was done locally with input from certain advisors, whose biases were apparent in the outcome. It was also reflected in some rather dubious conclusions, such as a lower baseload energy utilisation over the coming decades in South Africa, compared with the IRP 2010 predictions. This was presumably based upon decelerating economic growth in South Africa and renewables related trends in other parts of the world. These are not entirely applicable to a region such as southern Africa, which has not reached comparably high levels of installed baseload capacity.

One of the arguments, and one of the flaws in the IRP update, related to the affordability of a nuclear build programme. Based on the EPRI analysis and global findings, nuclear power is not significantly more expensive than gas, coal or hydropower. However, any cost differential appears to be exacerbated, largely because with nuclear the upfront cost is bigger.

Illustrating the debate around costs, Dr Dawid Serfontein, a nuclear engineer at the North West University, did some financial modelling. This exposed some input assumptions of South Africa's IRP update draft of 2013, as unrealistically disfavouring nuclear power. Such assumptions had led to the IRP update suggesting nuclear power is not cost competitive.

Serfontein's financial modelling, which was part of the submission by Nuclear Industry Association of South Africa (NIASA) on the IRP update, showed that nuclear energy could in fact be cheaper than coal energy even when worse case cost assumptions are made.

Serfontein noted that while nuclear plants are more capital intensive than most other power plants, they last longer. A life of 60 years compared with 40 to 50 years for coal-fired plants. Nuclear power also has a much higher capacity factor (of over 90%) than all other power generation options. The biggest flaw regarding nuclear power in the IPR and its update related to some of the input assumptions for the levelised cost of electricity (LCOE), which is the average generation cost, excluding transmission and distribution over the whole life of the plant. In the IRP it was calculated (measured in constant 2010 rand/kWh) as a function of the real weighted average cost of capital (WACC). The WACC is the combination of the real interest Eskom or the government must pay for a plant and the real percentage of profit which government demands from Eskom. The South African Integrated Energy Plan (IEP) and IRP update studies used high real WACC percentages or high real discount rates that were typically between 8% and 11.3%.

A high WACC percentage, or discount rate, dramatically raises the LCOE of nuclear power. The extreme sensitivity to this WACC figure is because the capital cost of a nuclear plant is about twice that of a coal plant. However, since NERSA has limited the post-tax WACC that government may demand from Eskom to 3.7%, these high WACC percentages and discount rates used in the modelling are unrealistic and out of line with established South African government policies.

In fact, should government be willing to accept a zero return on its new build investment, not an unreasonable position taking into account what it will gain in job creation, poverty reduction and increased economic activity, Serfontein submitted that nuclear power could become profitable at R0.45c/kWh while coal would run at a loss until the price is increased to R0.71c/kWh, a much higher breakeven cost.

It should be noted that much has been made of the cost of the potential nuclear build programme, with an often repeated figure of R1 trillion. This number is in fact a biased estimate originally made by anti-nuclear commentators, and was subsequently oft repeated. It differs greatly from the R300 billion figure used in the 2010 IRP estimate (by now this will have

scaled up to double that figure taking into account inflation and rand depreciation).

While focus has been on the public announcements, such as Zuma's State of the Nation Address of February 2014, preparation for a nuclear build programme has been underway for many years. Since 2007 several hundreds of millions of rand have seen spent in South Africa preparing for the new nuclear build.

Delegations including members from key ministries and industry have visited all the major vendors that offer nuclear power technologies. These study missions included Russia, France, South Korea, Japan, China and the USA and included visits to GE and Westinghouse in the US, Areva in France, Kepco in South Korea, Tepco and Hitachi in Japan as well as Rosatom in Russia.

All of these countries and groups offer generation III or better pressurised water reactor (PWR) technologies. South Africa will not consider anything less than generation III technology. While the technology from the different countries is broadly the same, there are differences between the offerings. The Russian technology has the steam generators standing horizontally.

The French generation III PWR reactors are 1,600 MW units, of which six would be needed if the 9.6 GW is adhered to in South Africa. The US reactors are about 1,100 MW in size, which means more contingency is possible, with nine US reactors in place of six French ones. The Korean technology features a reactor size of 1,400 MW and that of the Russians 1,200 MW.

Localisation is one of the key items in the planned build programme and the deal/vendors best able to accommodate that will have an advantage. For South Africa, some such opportunities were lost with Kusile and Medupi, as items were sourced overseas due to insufficient directive from Eskom to insist on the build programme, focusing as much as possible on local input.

South Africa has the internal capacity available to build much of the nuclear plant itself, outside the actual nuclear island component. Medupi and Kusile, while much maligned for being behind schedule, are creating important skills. An operating unit at Medupi has been delivered, and some things have gone right with the building of the power station.

A study by Worley Parsons indicated that 27.4% localisation on a nuclear build programme would occur naturally for the first two units, and that with effort this could be progressively increased to 53.4%. The mean value of local content for a build programme is estimated at 40.4%.

Overall, there are a few fairly basic things to consider with the planned nuclear build programme. Firstly, it will not go ahead without political support and in politics the right thing can happen for the wrong reasons.

Second, if one has to consider just anecdotal evidence of how affordable nuclear energy is: France, with its baseload nuclear power has relatively cheap electricity prices compared with many countries in Europe. France has almost half the price of electricity than Germany, which has abandoned nuclear power.

Third, South Africa has to add significant baseload capacity if it is to have the energy available for economic growth, and the biggest disaster is if nothing at all were to happen. Thus the plans for a nuclear build should not be seen in a very negative light.

Much worse than spending the country's resources on useful long life infrastructure, which will be a boon to future generations, would be spending the same money on a bloated and inefficient civil service that provides little other than remuneration to the direct beneficiaries, and for which future generations must pay the debt. A nuclear build provides a much better allocation of resources than many other options South African could consider.

Fourth, the choice of vendor and vendor country is important, since such a relationship has to last for at least 50 years. The choice of a vendor country that is a dictatorship under international sanctions, and subject to potential great future turmoil, should be viewed with caution.

South Africa is a country with poor leadership, and what can be euphemistically called a rent seeking elite, but the attempts to subvert the nuclear procurement process will be an interesting test. The financing required is huge and will have to be sourced internationally. No matter who the financial providers are, there will be some checks and balances, since those capital providers will want some confidence that their return is guaranteed – it means the project has to work.

In addition, the nuclear power industry globally can be compared to the aviation industry. There are global standards, safety criteria that nuclear power providers cannot afford to ignore, since one major incident can unravel an industry that has been under sustained attack for decades.

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Thus, like the aviation industry, the global nuclear industry will endeavour to make sure certain standards are met - it has to. Such factors will limit the influence and may even fatally damage the prospects of crude and greedy rent seekers.

South Africa has proven, with older technology in the form of Koeberg, that it is capable of maintaining nuclear power standards - and there is no reason to assume it cannot continue to achieve the same. In spite of attempts by anti-nuclear lobbyists to create perceptions to the contrary, nuclear energy does have a superior safety record to other energy forms. For every 10 billion kWh of coal-fired energy production there are 33 deaths. This number increases to 55 for the equivalent amount of hydroelectric energy. There are 1.6 deaths for the equivalent natural gas energy and 1.2 deaths for that amount of nuclear energy produced.

The decision to build Koeberg was as much about politics as (electrical) power. It was as much a political decision related to other forms of nuclear capacity and a desire to keep one of the five United Nations Security council members, France, on South Africa's side, and thus veto resolutions against the country during the height of the Apartheid era.

Construction of the plant began in 1976, and the two units were synchronised to the grid in 1984 and 1985 respectively. Very few people today recall, or care about, the politics surrounding the construction of the power station, and it will be hard to find anyone in South Africa today who would argue that Koeberg should be shut down. There is no reason history won't repeat itself with the new build programme.

Technically, and in terms of the location of load centres, and potential savings in transmission losses, new nuclear power stations situated at the country's coastal regions are a good and viable option. In decades to come it is more likely that South Africa will be thankful for, rather than regret, such an investment.

With a large scale capital programme to be undertaken by the state, there will always be the question of how corruption can be avoided. In a large national procurement programme there inevitably will be attempts at self-enrichment, particularly in the current environment and with the current calibre of political leadership in place. Thus the high public profile, a demand for greater transparency in the procurement process, and the questions being asked are to everyone's benefit. In many ways a nuclear build programme will be a litmus test of what South Africa is and what it aspires to be. wn

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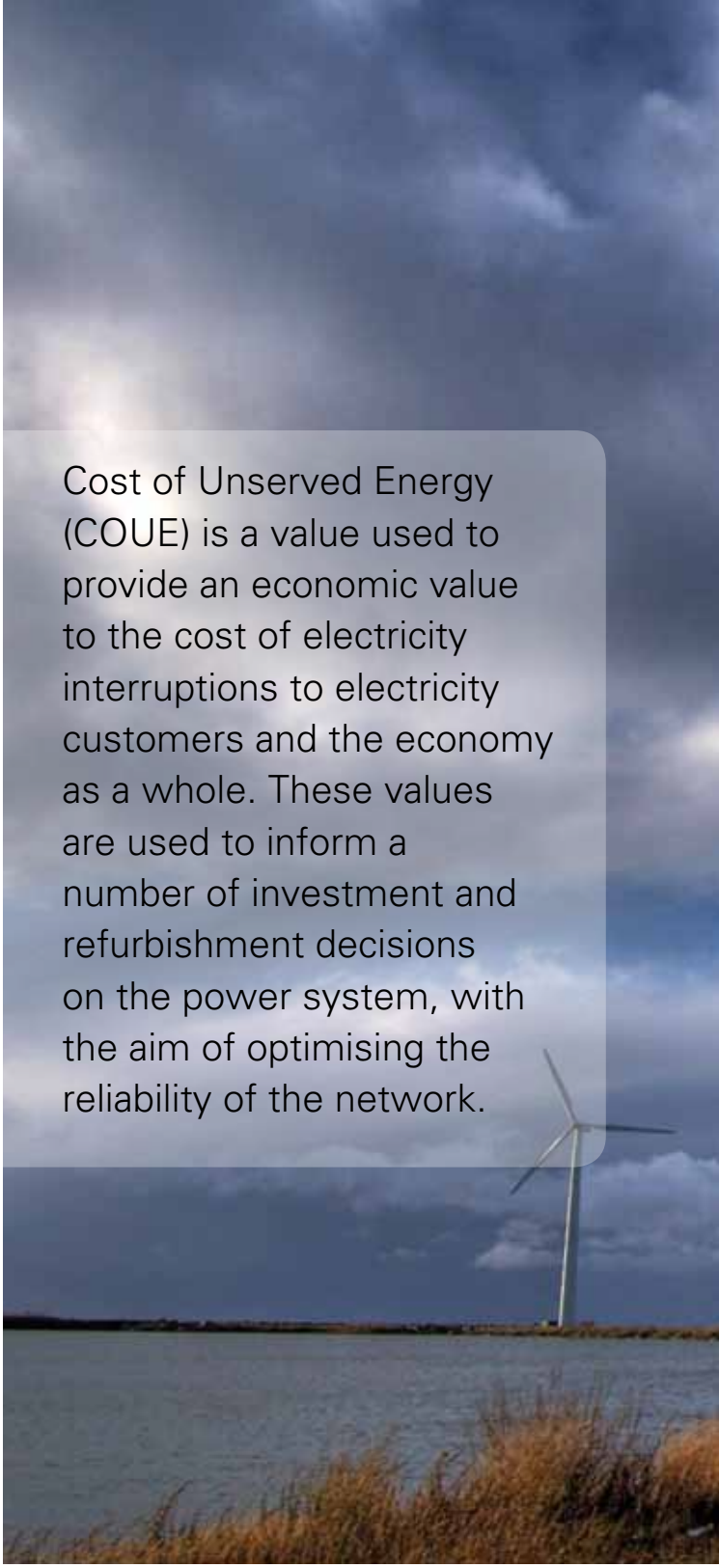


Cost of Unserved Energy (COUE) is a value used to provide an economic value to the cost of electricity interruptions to electricity customers and the economy as a whole. These values are used to inform a number of investment and refurbishment decisions on the power system, with the aim of optimising the reliability of the network.

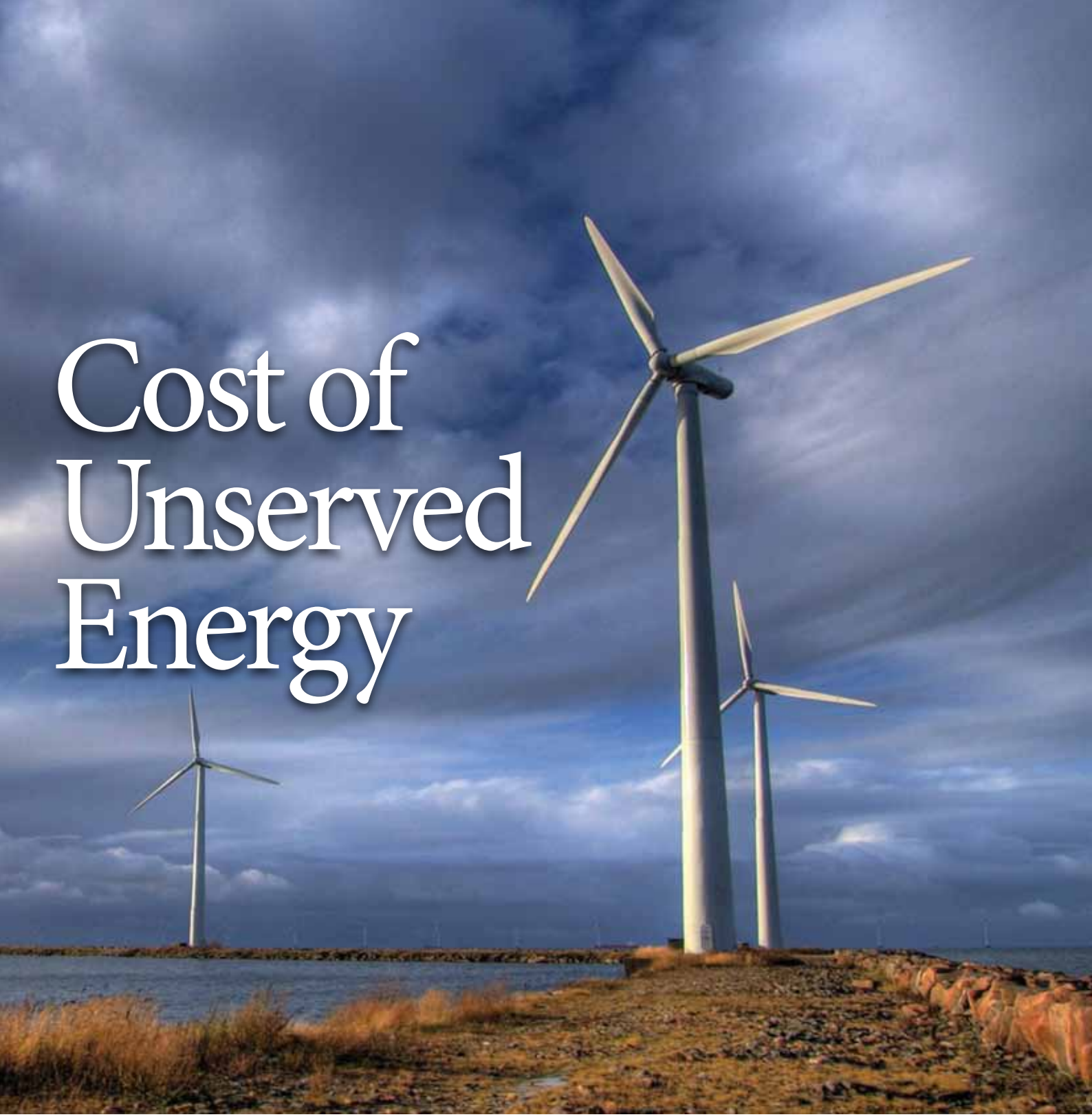
BY | DR ULRICH MINNAAR | PH.D | PR.ENG | SMSAIEE

he benefit of reducing the frequency and duration of electricity interruptions is quantified in economic terms, so that business cases for network investment, planning and refurbishment can be appropriately defined, and optimal levels of reliability engineered for the needs of the South African economy.

COUE is defined as the value (in rand per kWh) placed on a unit of electricity not supplied due to an unplanned interruption of a short duration (less than three hours). Such unplanned, short duration outage events are to be expected in a well-planned system with adequate reserve margin as a result of random failures of equipment.

Typically, a power system planner would balance the total COUE against the cost to supply the energy not served in order to make optimal planning decisions. It should be noted that these types of interruptions are different to loadshedding events and that the COUE calculated is not an estimate of the cost of loadshedding. The method assumes that businesses and households experience the outages as irregular and of low likelihood and short duration; and therefore little or no mitigation is possible or feasible.

Both the South African Grid Code and the Distribution Network Code require a NERSA-approved method of determining Cost of Unserved Energy (COUE) as a key economic parameter for network investment criteria. Additionally, COUE is defined as an input parameter to the Integrated Resources Plan for generation investment.



Cost of Unserved Energy

The determination of COUE is part of a NERSA process, that has led to a method for Cost of Unserved Energy being developed, as a joint collaboration between NERSA and Eskom. At the time of writing, the developed methodology was under consideration by NERSA for grid code requirement approval.

WHERE AND HOW IS COUE USED?

The impact of a decision of an investment on the reliability of supply is usually measured by the change in the amount of unserved energy experienced due to interruptions of supply. The evaluation of its worth to the customer requires a knowledge of the cost of unserved energy, i.e. of the economic losses associated with a unit of unserved energy. To this end, the COUE figures are one of the key economic evaluation parameters for investments to upgrade and refurbish the network at Transmission, Distribution and Generation levels. Generation planning requires COUE to assess the risk of economic damage (at macro-economic

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level) as a result of generation capacity inadequacy. This planning is concerned both with constrained economic growth, as well as total losses in the economy resulting from interruptions.

Investment in the Transmission System can occur when the specified technical and investment criteria is met. The economic impact of losing a load or not being able to supply a load needs to be determined, before a decision is made regarding new investment. COUE is one of the economic parameters used by Transmission when making investment decisions.

COUE is also used in the justification of capital expenditure required to implement a project. The Least Economic Cost (LEC) method is then used to justify the project. Planning expansion projects are based on N-1 criteria; therefore, COUE will have no impact on transmission network expansion planning. However, refurbishment projects require COUE, as the level of impact on some refurbishment projects will depend on the customer profile of the individual network.

Distribution uses COUE for load forecasting, reliability based planning and investment decisions. Load forecasting is premised on sub-zone classification and customer class building up from sub-station level. This requires economic impact measurement disaggregated by sub-station and by economic segment. Reliability-based planning uses the COUE values in a way similar to Generation to support capital investment breakeven planning. Distribution Planning also uses COUE in evaluating life cycle Least Economic Cost Infrastructure Investment of various alternatives. The cost of the project to the electricity utility is weighed against the (cost) impact to customers of energy not served if the project is not done.

DETERMINING COUE

Internationally, several methods are used to determine COUE, primary amongst these are macro-economic methods and customer surveys. Both methods have distinct advantages and disadvantages.

The macro-economic method uses official, published macro-economic data such as gross domestic product (GDP) (and gross value added (GVA)) and household expenditure measures. This method divides the macro-economic indicators by total electricity usage to estimate a cost of interruption per kWh.

The advantages of the macro-economic method include:

- It is feasible and simple to implement as a result of data availability
- It uses official, publicly available data – and is thus, transparent, verifiable and repeatable
- The method is consistent with the System of National Accounting (SNA) methodology of the United Nations
- It enables and supports macro-economic modelling
- It allows for scalability of COUE measures from a national level to higher resolution (e.g. municipal level)
- It provides measures that support the data requirements of reliability planning.

The key disadvantage of the macro-economic method is that it assumes that macro-economic indicators are a reasonable proxy for costs of unserved energy. This is because it is based on macro-economic estimations, and no data is collected directly from customers. It is insensitive to variations in costs associated with time-of-day, day in week and time-of-year in which interruption occurs

This method uses survey questionnaires to collect data from customers on the impact of unserved energy. It is based on the assumption that the customer is in the best position to assess his/her particular costs.

Survey questionnaires may either ask customers to estimate what happens in the event of hypothetical interruptions (stated preference), or alternative may use revealed preference methods.

The major advantage of customer surveys is that they enable marginal analysis and thus addresses the key weakness of the macro-economic method. These methods should, in principle, provide accurate COUE estimates. In addition:

- These methods could capture variations in costs for differences in time-of-day, day in week and time-of-year in which interruption occurs.
- These methods collect direct feedback from customers.
- These methods enable specific customer populations to be targeted through appropriate sampling techniques.

At the same time the method has, however, several disadvantages.

- Firstly, responses are at risk of bias, especially where stated preference methods are used. Bias may have multiple sources. It is possible that customers may understate their true willingness-to-pay or overstate their damage costs in an attempt to secure discounts on high tariffs.
- The accuracy and repeatability of the survey are highly dependent on survey

design and implementation. Customers who experience few interruptions have difficulty estimating the impact of interruptions, and therefore data received would be inherently unreliable.

Customer surveys are expensive and time-consuming to conduct, especially if scalability to high resolution is required. The time and cost implications of surveys result in extended time periods between updating results. For example, Norway has a long history of using surveys for determining interruption costs.

These surveys have been updated once a decade, with surveys conducted in 1990-1991, 2000-2001, and another scheduled for 2012. Similarly, in Italy, the only survey conducted was in 2003 and the Netherlands the surveys were conducted in 2004 and the results updated for economic changes, without conducting a survey in 2009.

The macro-economic method was chosen as the preferred COUE estimation method based on the advantages listed above. Moreover, since investment decisions are taken in the public interest on an on-going basis, this method has the additional benefits of being economically sound, repeatable (annually) and independently verifiable.

COUE METHODOLOGY: TOTAL ECONOMIC IMPACT

The COUE method estimates:

1. An Economic COUE for economic sectors that use electricity for production purposes; and
2. A Residential COUE for households that use electricity for various household applications

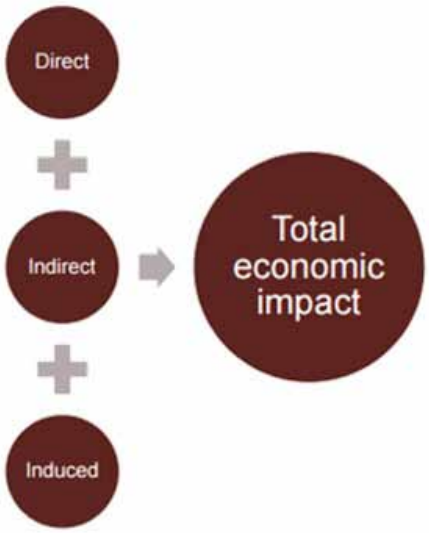
For economic activities, Gross Value Added (GVA) for relationship between GVA and Gross Domestic Product (GDP)) is used as an indicator of economic activity. The Economic COUE, following from the COUE definition, measures the value (in Rand GVA per kWh) placed on unit of electricity not supplied, due to an unplanned outage of short duration (less than three hours). Annual GVA and GDP, by economic sectors, are both officially measured and reported annually by Statistics South Africa. GVA and GDP are both measures of economic output. The relationship is defined as:

GVA + taxes on products - subsidies on products = GDP

As the total aggregates of taxes on products and subsidies on products are only available at the national economy level, GVA is used for measuring gross regional domestic product and other measures of the output of entities smaller than a whole economy.

The Economic COUE is expressed both as direct and total impacts on the economy. Thus, the direct cost of short duration power outages to the economy is measured in terms of production opportunity forgone, as GVA/kWh per economic sector. The direct Economic COUE is disaggregated to 62 ISIC sectors and 257 District and Local Municipalities. The indirect cost of these power outages to the economy is measured as the indirect impact on the economy as a consequence of the changes in sales and expenditure in the whole economy resulting from direct costs. These indirect costs to the economy, i.e. the costs associated with complex cross-linkages in the economy, is also measured in terms of GVA.

Figure 1: Total Economic Impact



The 1993 System of National Accounts (SNA) requires countries to compile annual Supply & Use tables (SU-tables) as it forms an integrated part of the 1993 SNA. Accordingly, the annual estimates of GVA and its components, as well as output, intermediate consumption expenditure, final consumption expenditure and GDP estimates all have their origin in the annual SU-tables. Stats SA uses the SU-tables framework to derive nominal estimates of GVA and GDP on a detailed, 62-sector, industry and commodity level.

The supply table shows the origin of the resources of goods and services, and the use table shows the uses of these goods and services and the cost structure of the various industries.

As a result, SU-tables report both the GVA generated by, and the electricity used by 62 different industries over a 12 month,

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calendar year accounting period. The electricity is a necessary production input for each of the industries to generate its GVA. The tables are reported in monetary terms and therefore the cost of electricity, as an input into production, is known, for each industry, and how much gross value is added in each industry.

As an analytical tool, the SU-tables are conveniently integrated into macroeconomic models in order to analyse the link and interaction between final demand and industrial output levels.

This type of analysis, which is also known as impact analysis, enables sophisticated economic impact analysis, including productivity analysis. In this way, StatsSA's SU-tables provide the foundation for development of an Input-Output (I-O) model and for analysis of the Total COUE effect. The COUE model adopts the methodology proposed by StatsSA for the construction of an I-O model from the SU-tables, and for analysis of results. Thus, the SU-tables provide a powerful analytical tool as they are conveniently integrated into macroeconomic models in order to analyse the linkages and interaction between final demand, intermediate consumption, GVA and industrial output levels.

The tables further report on all the other inputs from all the other sectors that are used for a specific industry to achieve this GVA. These are called intermediate inputs and explain the inter-industry relationships that exist in the economy.

Consequently, the COUE model uses the SU-tables to construct a single I-O table to establish the linkages and interrelationships between industries, products and other

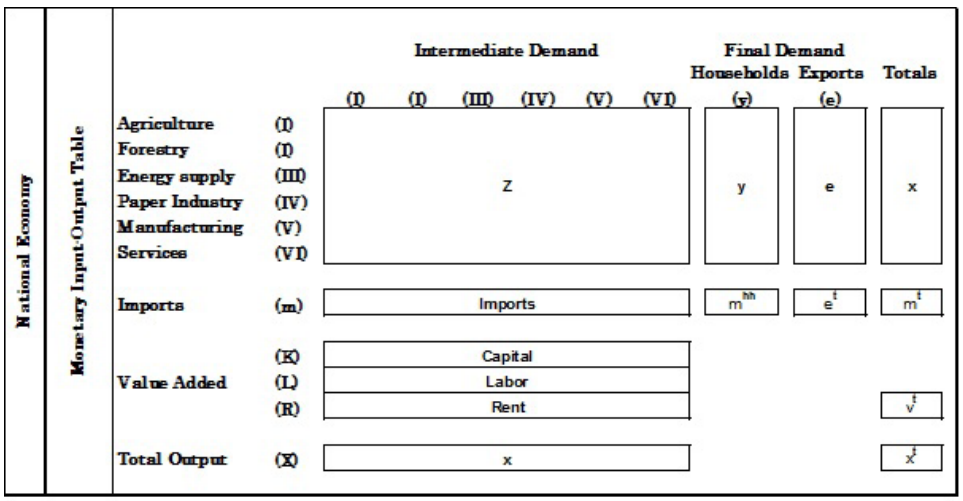


Figure 2: StatsSA Method for constructing I-O Table from Supply and Use Tables

economic variables. In the I-O table the rows represent the outputs and the columns represent the inputs. This I-O model enables the estimation of both direct and total effects of 1 kWh of electricity on the economy. This is achieved through two types of coefficient matrixes: Input coefficients and Inverse coefficients.

Input coefficients are estimated by dividing all the transactions in each column of the I-O table by the total output of each column. These coefficients describe the production input structure for each industry. However, input coefficients will only measure direct production and excludes any spill over effects throughout the rest of the economy.

The I-O table enables the derivation of the so-called "Leontief inverse" matrix which reflects not only the direct effects on the production process, but also incorporates the indirect effects on the production process, resulting from a change in demand for a specific product. This method is a well-established method and earned Wassily Leontief the Nobel Prize in Economics in 1973.

The Leontief inverse thus measures all the linkage effects and interrelationships between industries and final consumers and thus also the total impact on the economy. The "Leontief inverse" matrix enables the assessment of a scenario where 1 kWh is forgone/or gained in the economy.

The Residential COUE, in turn, is measured as the portion of household expenditure, by South African households, on goods and services that are electricity dependent, expressed as a ratio of residential electricity consumption. Residential lifestyles are increasingly electricity dependent for good and services such as communication, personal care, security, education, household income generation and leisure activities. Short duration power outages results in an opportunity cost of not having or using these goods and services and results in discomfort, nuisance and lost leisure opportunities.

RESULTS

The result of utilising the method is that COUE data for electricity investment planning is available on both a municipal

COUE: ECONOMIC EFFECT	DIRECT EFFECT (R GVA/KWH)	TOTAL EFFECT (R GVA/KWH)
Agriculture	13.97	51.06
Mining	9.00	36.43
Manufacturing	5.79	57.29
Electricity and water supply	7.34	27.60
Construction	196.47	376.83
Trade	101.26	124.98
Transport and communication	76.52	307.39
Finance	93.28	341.79
Community services	147.94	290.46
General Government	63.39	73.93
Total Economy	21.63	77.30

Table 1 lists the COUE for different economic sectors.

level (direct effect) and on a national (direct and total effect).

The Residential COUE assumes that households receive a utility (benefit) from electrical energy, measured by its expenditure on items that are electricity dependent. This utility is lost during an outage. This does not affect economic production (as in the case of the Economic COUE) but causes discomfort, disruption and nuisance. The Residential COUE is calculated by taking the household expenditure items that depend on electrical energy use, and dividing it by the domestic use of electricity.

The national aggregate Direct Economic COUE for 2013 (which is the latest available data from StatsSA) is R21.63 GVA/kWh. This number can be interpreted to reflect the weighted average direct economic production lost that can be expected, in an average year, as a result of manifold, short duration, unplanned power outages across the country. This value varies by industry, depending on the energy intensity of the industry.

The Total Economic COUE for 2013 is R77.30 GVA/kWh. This number can be interpreted as the weighted average total economic production lost that can be expected as a result of manifold, short duration, unplanned power outages across the country.

The Residential COUE for 2013 is R4.12 household expenditure/kWh. This number can be interpreted as the average discomfort caused to households as a result of lost opportunity to use electrical energy, as a result of manifold, short duration, unplanned power outages across the country.

COUE: HOUSEHOLD EFFECT	RESIDENTIAL
Total household income (compensation of employees)	1,610,647
Portion of household expenditure on electricity use	14.3%
Household leisure and convenience expenditure (R millions)	230,823
Total residential electricity use (GWh)	56,083
Residential COUE (R HH Expenditure/kWh)	4.12

Table 2

IN CONCLUSION

A COUE method has been developed that calculates an Economic and Residential COUE. The Economic COUE is based on Gross Value Added (GVA) produced in the economy and the electrical energy consumed to produce that value-add. The direct Economic COUE is also disaggregated by detailed industries as defined by the International Standard Industrial Classification (ISIC) system.

The Residential COUE assumes that households receive a utility from electrical energy, measured by its expenditure on items that are electricity dependent. This utility is lost during an outage event. This does not affect economic production (as in the case of the Economic COUE) but causes discomfort, disruption and nuisance.

The Residential COUE is calculated by taking the household expenditure items that depend on electrical energy use, and dividing it by the domestic use of electricity.

The COUE method provides a robust process for estimating both Economic and Residential COUE measures that are required by the capital investment criteria as prescribed in the Grid Code.

The methodology is based on data sources (inputs) published by nationally recognised institutions and authorities; therefore, the data inputs can be readily updated and the same results or outputs can be reproduced.

I am a strong supporter of the ETI because we need to urgently do something about youth unemployment in South Africa. Our youth unemployment rate is 52%, or four times the rate in sub-Saharan Africa as a whole, so it qualifies as a crisis. It demands that we take bold steps to resolve it.

As we take stock, however, there is reason to fear that some employers are profiting from the scheme by claiming the incentive for workers they would have employed in any case. In other words, they are benefitting from a taxpayer-funded tax break without necessarily creating new jobs.

My interactions with employers suggest that there are some that are not adhering to its spirit. Rumours abound of employers who keep remuneration below R6,000 per month in order that their employees qualify and the employer benefits.

According to government, 29,000 employers had claimed R2 billion from the scheme for at least 270,000 young people employed between October 2013 and February 2015. But there are no reliable numbers about how many of these youngsters would've been employed even if the ETI scheme didn't exist or what sort of training they're receiving. However, I suspect

Evaluating the Success of the Employment Tax Incentive

Now that we're just over halfway through the current legal life of the Employment Tax Incentive (ETI), it is opportune to consider whether the legislation has met its goal of creating new jobs for young people. The legislation is due to expire on 31 December 2016, so National Treasury and other government stakeholders will soon be debating whether it will be a good idea to extend it.

BY | ROB COOPER | TAX EXPERT | SAGE HR & PAYROLL

government would be shouting from the rooftops about its success if these metrics were favourable.

EXTEND THE ETI LEGISLATION BEYOND 2016

I can't predict whether the Treasury will extend the ETI but I think it would be a good idea to do so, provided it makes some significant changes to the scheme to improve its effectiveness. I hear many complaints from employers about the complex administration, particularly around the company's 'tax compliant' status, and the roll-over and refund procedures. These are a good place to start with a review.

Thus, some changes I would propose include the following:

- Remove the minimum wage compliance test completely, or at the very least make it clear that an hourly wage rate can be used for the wage qualifying test. Many people do not even understand what 'wage' is and confuse it with 'remuneration'.
- Simplify the current definition for the hours per month an employee under the ETI is 'in employment'. Again, some people are confused by the distinction between the hours someone worked in a month and the hours they were employed.
- Remove the tax compliance requirement or limit it substantially to reduce the risk of inadvertently claiming ETI while not tax compliant and being penalized.
- Allow youngsters to be appointed on a probationary basis so that employers can employ young people without fearing that it will be difficult and expensive to dismiss them if things don't work out.

Many trade union representatives and workers will find the last point unpalatable, but it is key to lowering the risk for employers of taking on unskilled and inexperienced young employees that may need a lot of training and guidance.

CLOSING WORDS

Ultimately, the ETI can only be a partial answer to the youth unemployment crisis. We all know that behind our unemployment problem is a lack of quality education. Our Statistician-General Pali Lehohle put it in a nutshell: *"Grey matter is what makes successful countries. It's not about the amount of gold you are sitting on."*

Even so, it's important to remember that the employment of even one youngster will keep him or her off the street and result in some money going back to the family.

This can help reverse the current cycle of poverty and social instability, and will gradually result in lower rates of unemployment amongst the youth, all to the benefit of our country and the economy. wn

YOUR TALENT ACQUISITION STRATEGY COULD BE HARMED

5 Recruitment Myths

Most companies understand that they will not succeed unless they recruit and retain the best possible talent. Yet many organisations still cling onto ideas about recruiting employees that are outdated or just plain wrong.

BY | ANJA VAN BEEK | HR DIRECTOR | SAGE HR

n many cases, their beliefs in these myths prevent them from finding the best possible talent for their businesses.

Here are five recruitment myths that companies should leave behind.

TECHNOLOGY CAN DO MOST OF THE WORK FOR YOU

Today, digital technologies such as career websites, social media platforms, website postings, and applicant tracking systems form an invaluable part of every recruiter's toolbox. But they are most effective when used to supplement the recruiter's skill and knowledge and to automate routine processes. They are not a substitute for a recruiter's knowledge, experience and business contacts.

A good internal recruiter or resourcing specialist will be able to assess candidates for soft qualities such as cultural fit or leadership skills.

This is an art rather than a precise science because a perfect candidate on paper might not be the right person for a job than someone with a slightly weaker CV. What's more, a recruiter will have the network to look for someone with rare skills when advertising online fails to bring in the right CVs.

THE BEST PEOPLE WILL COME FLOCKING TO YOUR BUSINESS

You might think that your status as a leading brand will ensure that the best people are banging down your door looking for a job. But it's not that easy.

People with the right experience and qualifications are in high demand and have no problem securing a job. You might have a strong brand with consumers, but how much effort do you spend building an employer brand that will attract the right people to your business? If you want the best people to work for you, you'll need to earn their attention and interest.

YOU START RECRUITING WHEN YOU HAVE A POSITION TO FILL

You should have a proactive recruitment plan that focuses on the needs of the business beyond today.

Actively think about the positions you may need to fill in six months or a year, and about the profile of the candidates you'd like to attract. Collect CVs and establish good relationships with people in your industry. One day, when you need to fill a role that demands rare technical skills, you'll know where to look for them and possibly even who to invite for an interview.

RECRUITMENT AGENCIES AREN'T WORTH THE TIME, BOTHER OR MONEY

Recruitment agents have earned a bad reputation in the market, and in some cases, they deserve it. There are many recruiters who charge high commissions and fail to deliver high-quality candidates to their clients.

But there are also good agencies with excellent contacts, who take pride in the work and take the time to understand each client's business and culture.

If you cannot justify the cost of full-time internal recruitment resources, a good agency can be a valuable partner. And even if you have a strong internal recruitment team, an agency might be able to support you when you're recruiting for scarce skills or when you simply want to broaden your exposure to quality candidates. Often, the time and money you'll spend trying to fill a specialist role yourself would pay the agent's fee several times over.

SMALL COMPANIES DON'T NEED A FORMAL RECRUITMENT STRATEGY

SMEs often hire ad hoc when the workload has grown and they need an extra set of hands to help. Often, they'll rely on word of mouth to find someone rather than taking the time to advertise the new job and interview candidates.

Using internal referrals can be beneficial as employees know the business culture and the quality of candidates required. This should however not be the only approach as you would not know what other candidates have to offer and you could miss an opportunity to build a sustainable team.

All SMEs should take the time and focus to attract the best talent to help build the business. wn

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

Can I use a three phase motor on single phase power supply?

ANSWER ONE

With the ongoing improvements in technology and also cost reduction on small size Variable Speed Drives (VSD), three phase motors can now be used on single phase power supply. In this scenario you will still make use of your existing single phase power supply to the drive. The VSD would generate a three phase voltage output to feed the motor 220 V.

Most three phase motors, 3 kW and below, are manufactured 220 V three phase in delta connection and 380 V in star connection. It is relevant to mention that the use of 220 V single phase supply input of a VSD is only applicable if your three phase motor has a 220 V connection.

During this process the VSD will rectify the voltage and from a DC link, provided by a capacitor bank and bridge rectifier (diodes), switch the voltage on and off with the insulated-gate bipolar transistor (IGBT) to create the three phase signal on the output to feed the motor. The IGBT makes use of pulse with modulation to simulate an AC wave form.

Something to note is also the availability and accessibility of three phase motors vs single phase motors. Most reputable motor suppliers would have 3 phase motors, as well as VSDs, available as stock items and there are additional technical features that come with this combination.

For Example, Motor protection is one of the highlighted features of a VSD as opposed to single phase motor protection options.

QUESTION TWO

What advantages does this give me over using a single phase motor?

ANSWER TWO

In general three phase motors will present a better efficiency and power factor than a single phase motor. A reputable motor manufacturer would be able to explain these benefits to you in greater technical detail.

There is a significant weight advantage, as single phase motors are more often heavier than their three phase counterparts.

Besides the performance and reliability of the motors, by using a three phase motor running on a VSD, it is also no longer necessary to have a Direct On Line (DOL)

starter with contactors and thermal relays, as all the protections are now built into the VSD. Single phase motors do not have inherent phase or under voltage protection. Using the VSD on three phase motors affords you full motor protection.

Three phase motors have proven to be much more reliable with VSDs and they require less maintenance, whereas single phase motors with direct on line starters have capacitors and internal switches that require regular maintenance.

On single phase motors, we rely on the motors internal centrifugal switch to open at around 90% of full load speed, disconnecting both the starting capacitor and auxiliary winding from the circuit. With the VSD, we can control the starting time of the motor at reduced starting current, giving you more flexibility.

With regards to starting current, single phase motors will use 6 to 8 times the full load current to start with a Direct Online Starter. A Three phase motor and VSD will only use 1.5 times the full load current to start. The reduction in starting current usage can be very beneficial.

The VSD further will provide additional features not available on a normal starter such as:

- Current reading
- Speed reading
- Under voltage protection
- Phase protection
- Fault history
- Speed variation allowing power saving i.e. pumps and fans (variable torque applications).

Taking all of these factors into account the total cost of ownership of the three phase motor and VSD combination can be much more economical than a single phase over the lifetime of your motor. wn

Answers provided by Zest WEG Group

IN MY OPINION : PETER KENWORTHY

Engineered consent in Swaziland

Imagine you've started your first job after a year's unemployment of endless number of job applications, after finishing your engineering degree. You are excited, not least because you have had no source of income while unemployed and because several of your friends speak of their newly found jobs on Facebook and LinkedIn.

BY | PETER KENWORTHY **|** JOURNALIST

What you are met with is an unsigned contract of employment with no job title and no mention of wage rate or working hours. You receive no introduction to your new work place.

You have to pay for your own tools, and are met with racism, poor working conditions with multiple accidents and ill-treatment once. Your wages turn out to be US$10 a day, the same as an unskilled domestic worker.

This is what 27-year-old Mkhonzeni Dlamini experienced while working as an assistant electrician for a sawmill company in the small absolute monarchy of Swaziland, as he outlines in his second book "delayed dreams".

DESPERATE FOR WORK

Dlamini had studied electrical engineering at the University of Swaziland. He had grown up in a mud hut in the rural areas of Swaziland, with barely enough money to eat or to attend school, and he and his family had to make great sacrifices for him to attend and complete his engineering degree.

With his degree and job opening, he was now looking forward to being able to support himself and his family. Both his mother and father are ageing and unemployed and caring for one's parents is a burden successful family members have to bear in Swaziland, says Dlamini.

But after a month he had nevertheless handed in his resignation. He was fed up with the racist remarks from management, threats of dismissal for trivial matters and fellow workers being kicked, slapped and beaten by their seniors.

His fellow workers stayed on, too desperate for work in a country with over 40 percent unemployment and where over two thirds of the population survives on under a dollar a day. *"They can be paid peanuts and ill-treated but they won't complain since life is too miserable for most of us"*, writes Dlamini.

Mkhonzeni Dlamini

Rural Swaziland

'WE CHANGE BUT REMAIN UNCHANGED'

"I made changes in life. I saw myself better off than others. But I saw no change and I remained like everybody. Life is a merry-go round. We change but remain unchanged", Dlamini continues.

A short but highly relevant comment on living in an absolute monarchy, where your opportunities and place in society are almost fully dependent on your connections and willingness to comply with the decrees of Swaziland's absolute monarch, Mswati III.

"In Swaziland you can rarely find a company or government parastatal whose board of directors does not include a prince, princess, chief or the king's business associate. We live in an absolute monarchy where the king is above the law", as Dlamini puts it.

DON'T ACCEPT DEFEAT

"My stick-and-mud house was no more safe, termites had destroyed most of the supporting poles on the wall and roof. To avoid the iron sheet from being blown away by the wind I had placed some old car tyres and bricks on the roof", Dlamini says of his present predicament in what is a fitting metaphor of the state of Mswati's kingdom.

"Most of us in Swaziland are subjected to oppression and others have become accustomed to oppression and no longer express any resistance to it. They have accepted defeat", he continues.

Not Mkhonzeni Dlamini, however. After resigning, he wrote a letter of resignation that eventually led to several changes in the company he had worked for, including the introduction of management skill courses, his racist and violent superior being reprimanded, and the arrival of his final pay check that had been missing.

He wrote a book about his experiences where the last sentence reads *"if any man were to believe in himself and unite with like-minded people, nothing can stand in his way"*.

THE FUTURE

For his part, Mkhonzeni Dlamini wants to take a postgraduate degree in Engineering, depending on whether he can get a scholarship, after which he wants to work as a consultant engineer and part-time lecturer, he tells me. He also plans to write several more books in his series about life in Swaziland.

As for the future of Swaziland, he is less optimistic. *"The future of Swaziland is gloomy, everyday things are getting worse"*, he says. Dissenting voices are therefore on the rise and there is subsequently a real possibility of talks between the democratic movement and the king.

"In my opinion these democracy talks are merely a PR-strategy by the regime. The prerequisite for such an exercise would be to first unban political parties, release political prisoners, call for the return of exiles and allow freedom of speech and association", says Dlamini. wn

October

Movers, shakers and history-makers

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

1 OCTOBER

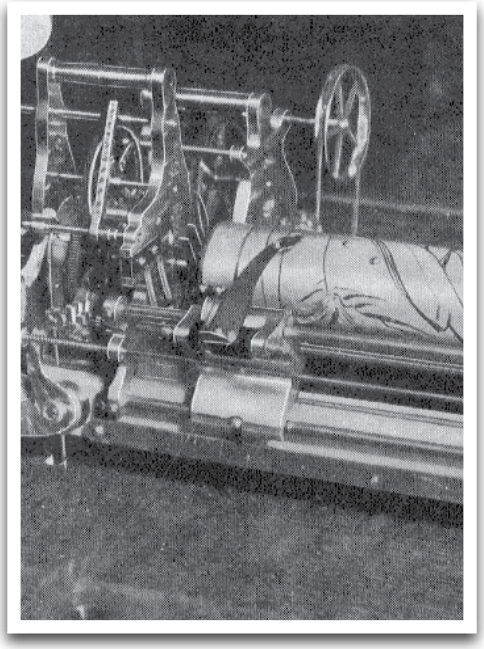
1962 The world's first academic department of computer science was established at Purdue University, although the first Ph.D. in computer science was awarded by the University of Pennsylvania in 1965.

2 OCTOBER

1955 The ENIAC, the first general-purpose electronic computer in history, was ceremoniously decommissioned after nine years in service.

3 OCTOBER

1922 A photo was sent via facsimile over public telephone lines for the first time. It was sent between 1519 Connecticut Ave and the U.S. Navy Radio Station NOF at Anacostia in Washington D.C.



4 OCTOBER

1955 A cable repairman made the first solar powered telephone call using a Bell solar battery.

5 OCTOBER

1962 United Artists releases the first instalment in the James Bond film franchise, the spy film Dr. No, starring Sean Connery to UK theatres.

6 OCTOBER

1889 William Kennedy Laurie Dickson, the inventor of the motion picture camera and an employee of Thomas Edison, made the first motion picture with sound, in which he filmed himself saying *"Good morning, Mr Edison. How do you like this?"*

7 OCTOBER

1806 Ralph Wedgewood patented carbon paper, which he described as an "apparatus for producing duplicates of writings" in London, England.

8 OCTOBER

1926 Julius Edgar Lilienfeld of New York, filed for a patent for a "Method and Apparatus for Controlling Electric Currents."

The application described an NPN junction transistor and its use as an amplifier.

9 OCTOBER

1894 The first "magic lantern" feature was shown at the Carbon Studio in New York City. Magic lanterns are early precursors to latter-day cinema projectors.

10 OCTOBER

1796 The metric system was born. The date (10/10) was chosen as an allusion to the base ten system of measurements.

11 OCTOBER

1999 Principal photography on all three of the films of The Lord of the Rings film trilogy began in New Zealand. It was completed on December 22, 2000 after a record-setting 274 days.

12 OCTOBER

1915 The Ford Motor Company manufactured its one millionth Model T car.

13 OCTOBER

1998 Thousands of Ugandan university students were unable to determine their academic placements at the National Examination Board due to defective computer cables that were chewed up by rats.

14 OCTOBER

1957 The British Computer Society (BCS) was founded to represent those working in the Information and Communications Technology sector.

15 OCTOBER

1940 A five hundred pound German bomb scores a direct hit on the Broadcasting House in London during the 9pm BBC newscast, killing seven people. The BBC will not later report on the incident, as it is BBC policy not to comment on-air on such interruptions.

16 OCTOBER

1908 In Farnborough, the first aeroplane flight in England was accomplished by Samuel Cody, a self-proclaimed American cowboy who built his own flying machines.

17 OCTOBER

1933 Physicist Albert Einstein emigrated to the United States, fleeing his former home in Nazi Germany.

18 OCTOBER

1842 In New York Harbour, inventor Samuel Morse lays the world's first telegraph cable, across the length of a mile between the Battery and Governor's Island. Unfortunately, before his system can be fully demonstrated, a passing ship pulls up the cable.

19 OCTOBER

1832 Samuel Morse would later cite this date as the day he first conceived the electric telegraph system.

20 OCTOBER

1955 The Return of the King, by J. R. R. Tolkien, the third and final book of The Lord of the Rings trilogy, was published by Allen & Unwin, Ltd.

21 OCTOBER

2008 eBay announced that as of 1 January 2009 it would institute a global ban on the sale of any and all ivory products.

22 OCTOBER

1968 Apollo 7 safely splashes down in the Atlantic Ocean after orbiting the Earth 163 times.

23 OCTOBER

1981 The New York Times published an article entitled *"When Computers Don't Work,"* in which Andrew Pollack writes that *"The effects of a non-performing computer can go beyond frustrated expectations. A small business can become so critically dependent on a computer for its billing and accounting that, if the computer errs, the business can go bankrupt without even realizing it."*

24 OCTOBER

1861 Western Union completed the first transcontinental telegraph line across the United States, and brought about an abrupt end to the legendary Pony Express, which had only been established eighteen months earlier and closed just two days later.

25 OCTOBER

1955 The first domestic microwave oven was introduced by the Tappan Stove Company in Mansfield, Ohio. It was only moderately successful commercially.

26 OCTOBER

1901 A "getaway car" was first recorded in history following the hold-up of a shop in Paris, France.

27 OCTOBER

1982 China announced that its population exceeded one billion people.

28 OCTOBER

1914 "Hookless No. 2", the first hookless fastener developed by Gideon Sundback, went on sale. Later it would become known as a zip.

29 OCTOBER

1675 Leibniz, a German mathematician, introduced the long s (∫) to denote an integral in calculus equations.

30 OCTOBER

1938 A radio adaptation of "The War of the Worlds" (H.G. Wells) caused panic amongst the American nation. A large number of listeners tuned into the program ten minutes late, after another show, thereby missing the introductory warning that the program was purely fiction and were fooled by the news-style format of the program.

31 OCTOBER

2005 Apple announced that it has sold one million videos through its iTunes Store in the nineteen days since it started selling videos, October 12th. Steve Jobs commented that, *"Selling one million videos in less than twenty days strongly suggests there is a market for legal video downloads!"* wn

True Engineers - a dying breed?

Finding a true engineer is a process of elimination, akin to separating the weeds from the wheat; and then the wheat from the chaff.

BY I ANGELA PRICE

This process is not made any easier by the fact that the term 'engineer' seems to carry different weight and meaning in different countries.

Recently my husband and I were in the UK for a family wedding, and when asked what he did for a living he would reply, 'Electrical engineering' - typically the response went along the lines of:

Them: *'Ahhh right…fab… so can you like wire up a house or summat?'* * (Pause - as we both mentally picture the size of mineral plants he has 'wired up').

Us: *'Um…..ya'*

Quickly dubbed 'a bright lad that one' most folks seem to drift off to talk about/to someone deemed more interesting.

We soon came to realize that in the UK the term 'engineer' isn't protected. Confusingly, fitters and technicians are also referred to as engineers. If there was a problem with your central heating for example, you wouldn't call for a repair technician, rather you would ask for British Gas to send through their heating system engineer to fix the problem.

We couldn't quite ascertain if this was just to help motivate people/staff and make them feel better about themselves or if it was a clever way of being able to charge more for ones services.

From my own observations in SA, I always believed the process of identifying 'real engineers' was efficiently managed by secondary and tertiary education.

Those of us non-engineering types were very quickly identified and 'weeded out' somewhere around grade 10 (formerly standard 8) when we could choose to drop subjects like science and (I am ashamed to admit) take maths on Standard Grade.

Many of those 'rooted out' went on to the more colourful and flowery career choices: designers, writers, artists and the like - we make the world a more beautiful place (or so we like to believe). Those that finished Matric with top marks then went on to tertiary institutions with most signing up for medicine, law or engineering. Engineering students were then further divided up between the engineering disciplines; chemical, mechanical, electrical and so forth.

I think it is around this stage that a man's true 'metal' begins to shine through and their real reasons for choosing the 'not too easy' engineering route begins to surface.

Sadly for us all we have no Hogwarts Sorting Hat which can discern your true heart or gifting and 'pop' you into the right career path. Many a student drops out along the way in first year engineering, possibly having finally found the courage to tell dad that their hearts desire was to be a muso or mime artist.

Those that finally graduate should justifiably feel as proud as punch.

After graduating as a professional engineer there is still one final test or sorting table process, after which only the true engineers are left standing - financial reimbursement.

Many engineering graduates are seen leaving the field of engineering upon graduation and branching out into the IT and banking environments which usually offer far higher pay incentives. I believe that those who stayed within the engineering arena are those who are truly called to be engineers.

Granted there is a long line of engineers in our family, but when I ask my husband, '... why engineering?' - he always answers *'I only ever wanted to be an engineer, I want to change the world and make it a better place'*.

And you true engineers do.
Thank you. wn

**summat = English slang for 'something'*

calendar

SEPTEMBER | OCTOBER | NOVEMBER

OCTOBER 2015

3	SHELL ECO Marathon - Registrations are open!!	Zwartkops, Johannesburg	estherk@uj.ac.za
4-7	AMEU Convention	Sandton, Johannesburg	www.ameu.co.za
7-8	Design of Economical Earthing Systems for Electrical Installations	Johannesburg	roberto@saiee.org.za
7-9	Fundamentals of Long Term Evolution Mobile Communication	Cape Town	roberto@saiee.org.za
11-13	FILTECH 2015	Cologne, Germany	www.filtech/de
14-15	Effective Technical Document Writing For Engineers	Johannesburg	roberto@saiee.org.za
14-15	Core Financial Management for Engineers	Johannesburg	roberto@saiee.org.za
19-21	Fundamentals of MV Protection	Cape Town	roberto@saiee.org.za
21-22	Fundamentals of AC ARC Furnace Electrics	Johannesburg	roberto@saiee.org.za
21-22	HV/MV Circuit Breaker, Maintenance, Safe Operation & Theory	Johannesburg	roberto@saiee.org.za
21-23	SSA Power Summit	Cape Town	www.ssapower.com
26-30	CIGRE Symposium	Cape Town	www.cigre.org
27-30	2015 IEEE Radar Conference - Out of Africa	Sandton,Johannesburg	www.radarconf15.org

NOVEMBER 2015

2-4	Fundamentals of Long Term Evolution Mobile Communication	Johannesburg	roberto@saiee.org.za
6	SAIEE Museum Opening	SAIEE HQ, Johannesburg	geyerg@saiee.org.za
7	SAIEE Annual Banquet	Johannesburg	geyerg@saiee.org.za
11-12	Photovoltaic Solar Systems	Johannesburg	roberto@saiee.org.za
18-19	Leadership & Management Principles & Practice In Engineering	Johannesburg	roberto@saiee.org.za
25-26	Fundamentals of Practical Lighting Design	Johannesburg	roberto@saiee.org.za
26	SAIEE National Student's Competition	CUT, Bloemfontein	www.saiee.org.za

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16-17	Africa Energy Indaba 2016	Sandton, Johannesburg	africaenergyindaba.com
23-25	SAIEE Smart Grid Conference	Midrand, Johannesburg	www.saiee.org.za

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