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THE COMMUNICATION ISSUE

SAIEE THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS I **JUNE 2013**

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wattnow magazine

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It is June already, the days are getting colder and shorter and it is getting worse to get up in the mornings. We don our coats and woolies to brace against the cold air. Lights are on for longer and therefore the electricity crunch. Maintenance to be done in winter seems to be a looming reality.

This issue of **watt**now is jam-packed with lip-smacking goodness, an issue I thoroughly enjoyed putting together. It is informative and very interesting to see what the SAIEE Centers are getting up to as well as what is happening in the various industries.

The theme for this issue focuses on Communication, and the feature in this issue is a very interesting article from Jide Julius Papoola and Rex van Olst of Wits, "Dynamic Spectrum Access" - and they ask the question, what are the benefits of DSA? Get the answer on page 26.

On page 36, Garreth Johnson talks about the preparation needed for the winter power outages. Read it, you might be able to learn something new. I know I did.

In our Power Section, we sport an article from Johan van Den Berg who gives us the 'Green Solution' to South Africa's electricity crunch by bringing renewables to the rescue. Read more on page 38.

History will never let us forget the devastation the nuclear devices caused over Hiroshima and Nagasaki in WWII. The main ingredient - Uranium. Felix Bosch gives us a historical overview on Uranium Technology in this first of a two part series of articles. Read it on page 42.

I would need to write two pages explaining what you'll find in this issue, but instead, I'll let you read it for yourself.

Enjoy this issue!

*Visit www.**watt**now.co.za to answer the questions related to these articles to earn your CPD points.*

SAIEE MEMBERS

Write a winning Engineering article for **watt**now and win an iPad!

wattnow prizes will be awarded for articles written by SAIEE members that are published in the **watt**now magazine and that are adjudged 'excellent' by a panel of experienced engineers and academics. Articles of between 1500 and 2000 words in the Engineering categories of Communications, Control, Computers & Software and Power as well as General Interest and Science, written by SAIEE members, in good standing, and published in **watt**now will be eligible.

SAIEE members have broad and expert experience and knowledge about many Engineering projects topics in which they have been involved. **watt**now wants to access and record the experience and knowledge of the SAIEE member community and publish this to a wider professional audience.

Write about your (or others') experience and help to spread knowledge, interest in and history of our great engineering capabilities and achievements.

ARTICLES WILL BE JUDGED ON THE FOLLOWING CRITERIA:

- General technical professional interest
- Accuracy and Reliability, Technical Correctness
- Currency and relevance
- Coverage and Objectivity
- Style, language, illustrations, article structure, etc.

Awards will be made at the Annual SAIEE Banquet for the best article in each category, published between September and August of the past year. Note that a prize for each category is available but will only be awarded if articles are judged to be of a sufficient standard. The prizes for 2013 will be Apple iPads. The judging panel will be made up of experienced members of the Engineering fraternity, including academics and industrialists and their decision is final. Detailed rules are available on the SAIEE website - visit www.saiee.org.za

SAIEE
South African Institute of Electrical Engineers

The image of the iPad is not necessarily the model to be awarded.

Greetings to you all!

I started my year as president by vistinging the various SAIEE centres and my first visit was to the Eastern Cape Centre. I met the new Chairman Mr Dawid Bester and the local committee at Nelson Mandela Metropolitan University.

The address created a lively response from the delegates, and was followed by a social event giving SAIEE members and NMMU students a networking opportunity to discuss the future challenges of providing electricity to SA. The SAIEE Eastern Cape Centre committee, which has been particularly active in recent years, is supported strongly by NMMU engineering faculty members.

I then went on to visit the Southern Cape Centre in George which is chaired by Mr Robbie Evans.

This visit was followed by the traditional centre Chairman interactive workshop on at the SAIEE Head Office in Johannesburg, where the SAIEE Executive team met the centre Chairmen to exchange ideas.

The Centre Chairmen for 2013 are:

KwaZulu Natal - Veer Ramnarain
Western Cape - Phumelelo Ngxonono
Southern Cape - Robbie Evans
Eastern Cape - Dawid Bester
Mpumalanga - Sello Raphadu
Vaal - Denver Jacobs

This workshop has proved to be valuable for the Chairmen as it enables interaction and the opportunity to share and coordinate ideas.

I am of the opinion that the SAIEE centres should be more accessible to all members, and in future, I suggest that we should have a SAIEE centre, or at least an interest group, within easy travelling distance in all areas of South Africa.

In these days of modern communication, it should be made possible for any member to log in and participate, or at least to view the Council meetings. Perhaps we could organise a video stream of the Council proceedings?

Herewith some of the ideas discussed by the centre Chairmen:

- Expand the concept of teaching the teachers to all Centres in the country using the Bergville concept in KwaZulu Natal as an example. Let us consider introducing a pipeline to educate children about the fascinating world of technology. This may encourage some to enter the field of Engineering.
- As suggested at the meeting:- Introduce a system to help younger school going children understand and prepare for the rigorous requirements of registering at a University to study Engineering.
- Introduce technical games and lectures at schools that are aimed at developing an enquiring mind, to encourage learning about the environment and things that make engineering such an interesting field of endeavour.
- The allocation of student bursaries, and awards for top students

All the best for this month and we will chat again next month.

Paul van Niekerk Pr. Eng
SAIEE President 2013

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WATTSHOT

Gadgets and gizmos for you... go ahead, spoil yourself! You deserve it!

Code: 18506: 4-pack Solar Spiked Bollards – R199,95.

Code: 17823: Solar Mini Pathfinders - R109,95

Powered by the sun

One of the best and most inexpensive means of improving the aesthetic appeal of your home's outdoor areas is to add solar-powered outdoor accent lighting. The Lighting Warehouse's Decorative outdoor solar lighting can instantaneously uplift the visual appeal of your outdoor areas – giving them an elegant and inviting look at night, without adding a cent to your monthly electricity bills. For more info, visit www.lightingwarehouse.co.za

App Cufflinks Set (3 pairs)

Some people wear their heart on their sleeve – others wear their favourite Apps. This set of six cufflinks is perfect for the App-sessed. Choose to wear any combination of the Email, Message, Calendar and other well known Apps.

Features - Great corporate gift

- Choose your favourite app and wear it on your sleeve. **Price** R275 (incl.)

Emergency Phone Charger

This pocket-sized phone charger couldn't be simpler to use - just insert one AA battery and plug it into your mobile phone for an extra two hours talk time wherever you are! Not only that, it's compatible with iPods too! Compact and durable, it's very handy for those emergency situations when mains power isn't an option. **Price** R150 (incl.)

Snug Rug (Adult/Navy)

Warm, cosy and lightweight sleeved blanket, with luxury anti-pilling coral fleece, pouch pocker and carry case. A soft and rich winter warmer.

Oversized sleeves allow you the freedom to comfortably read, snack or work on your laptop whilst staying warm, snug and cosy.

Save on heating costs with this luxury sleeved blanket - ideal for lounging at home, long journeys in the car, even for camping.

Made from 260gsm luxury deluxe coral fleece - a richer and softer fabric.

Features

- Warm, cosy and lightweight.
- Anti-pilling both sides.
- With handy pouch pocket for your remote control, glasses or mobile phone.
- Packaged in carry case for travelling.
- 100% polyester coral fleece, machine washable.
- Measures 152cm x 214cm (60in x 84in).
- Available in Red, Navy Blue, Cream and Pink

Price R350 (incl.)

Pinball Master

Featuring an automatic scoring panel, double flipper control, spring action bumpers and electronic scoring noises, this tabletop machine will turn you into a Pinball Wizard faster than you can say 'HIGH SCORE'!

If you haven't got space for a full-sized pinball machine, this tabletop version is a fantastic alternative. Send the steel balls bouncing off the five central bumpers as you fight to keep them out of the danger zone - they'll even light up and emit space-age 'zap' and 'pow' scoring sounds as you hit them!

Features

Automatic scoring board
High score display
Spring action bumpers
Double flipper action
Light and sound displays
Requires 4 x C 1.5V Batteries (not included)
Price R399 (incl.)

Portable USB Notebook Tool Bag

All in one tool bag with a multitude of useful computer tools. This handy toolbag supplies everything you need for troubleshooting, testing, and system maintenance. You don't need to be a tech geek to wonder how you survived without it.

Price R225 (incl.)

Eton Axis Charger with Radio Weather-Alert & Flashlight

Be "Red-Cross" ready for any emergency! Severe weather, blackouts or in any remote area where you want to stay in touch. With the Eton American Red Cross Axis Weather Radio, you'll always be prepared for whatever Mother Nature throws at you! Digital tuner AM/FM radio and NOAA 7-channel weatherband with special "Alert" feature keep you informed. A built-in 4-LED light provides reliable illumination, while a flashing red emergency LED alerts others to your situation. Best of all, the Axis can be powered via 3 different sources: aluminum dynamo hand crank, AC power, or 3 AAA batteries (not included). Provides 15 minutes of power for every 90 seconds of hand cranking.

Rugged design, moisture-resistant - it even charges your cell phone! The Axis is designed to withstand heavy use, including connectors with rubber gaskets to seal out moisture: a 3.5mm headphone output, DC In, Aux In and a USB cell phone charger (cable not included). A telescopic antenna provides maximum range and reception.

Price R1,295 (incl.)

Giant Beer Glass

Bigger is always better and this giant beer glass is certainly better. The glass holds a whopping 2.5 pints of beer. Maximum respect from your fellow drinkers is guaranteed.

Features:

Holds 2.5 pint of beer, Great gift idea

Price R160 (incl.)

Powertraveller PowerMonkey Discovery

Housed in a stylish full aluminium case with 6 high bright pin point LED lights, the powermonkey discovery will recharge an iPhone twice, standard mobile phones 3-4 times, or give iPods / MP3 players up to an additional 120 hours playtime. It is also compatible with e-readers, Sat Navs, handheld games consoles, portable GPS systems and more!

Price R690 (incl)

All the products featured on pages 8 & 9 are available online at www.mantality.co.za unless specified differently.

WATTSUP

Gerda Geyer and Stan Bridgens, SAIEE HQ

Robbie Evans, Chairman Southern Cape Centre with Paul van Niekerk, SAIEE President

Sello Raphadu, Chairman Mpumalanga Centre and Veer Ramnarain, Chairman Kwa-Zulu Natal

Danver Jacobs, Chairman Vaal Triangle with Robbie Evans, Chairman, Southern Cape Centre

Phumelelo Ngxonono, Chairman Western Cape Centre and Dawid Bester, Chairman Eastern Cape Centre.

SAIEE CENTRE CHAIRMEN WORKSHOP

The SAIEE Centre Chairmen graced Head Office with their presence at their annual Centre Workshop. The Chairmen enjoyed a relaxing lunch and mingled with staff and Office Bearers before they entered into their workshop, discussing budgets and planning for 2013.

Office Bearers: (l-r) Andre Hoffmann, Viv Crone, Mike Cary, TC Madikane and Paul van Niekerk.

POWERTECH TRANSFORMERS

Powertech Transformers, a subsidiary of Powertech and the JSE listed Altron Group, announced that they have recently installed in their Pretoria laboratory, state-of-the-art Brockhaus equipment which is used for testing of core steel, making it the only company in Africa with this type of equipment and one of only a few companies in the world.

Bernard Meyer, CEO Powertech Transformers (PTT) says *"Incoming material control and verification of supplier routine test results for critical material items such as electrical core steel is of utmost importance to PTT. This drives customer confidence as a reputable OEM of power transformers. No-load losses are important guaranteed design and manufacturing parameters in terms of contractual compliance and therefore necessitates full control of our Supply Chain for electrical core steel."*

RENEWABLE ENERGY PROJECT

The Renewable Energy Research Group in the EBEIT faculty is currently busy with a number of RE projects related to maximizing energy yield from small domestic scale wind and solar devices. The concentrated solar power (CSP) heating of a vacuum insulated rock bed using air as transfer medium is showing promise as a technology for retaining heat during periods of inclement weather.

Another exciting development is the NMMU patented segmented blade horizontal axis wind turbine (HAWT). This unit automatically aligns all parts of its blade optimally with the exact relative airflow passing over the blades. Testing will commence soon to verify what advantage this will have over existing designs with emphasis on enhanced daily yield.

Paul van Niekerk, SAIEE President, with the NMMU students involved in the creation of the Solar Car Project.

THE SOLAR CAR PROJECT

The Solar Car Project is the first of its kind to be undertaken by Nelson Mandela Metropolitan University (NMMU) students, and is in line with the environmental consciousness that the university endorses. The team consists of students from Mechanical, Electrical and Mechatronics Engineering fields. The students originate from a wide range of backgrounds, both nationally and internationally, which positively enhances the dynamics of the team. They also have a broad skills base, ranging from initial tertiary qualifications up to masters level. External advice and skills have been received from staff members at NMMU, and local companies; who also share a passion for the future of 'green engineering'.

The project was initiated in 2010 and has progressed from initial student designs to a unique physical response to the Sasol South African Solar Car Challenge 2012. The team has created a unique vehicle designed to the strict race specifications dictated by the FIA and SASC. The project has received major financial funding from the Technology Innovation Agency (TIA), Volkswagen South Africa (VWSA) and the Automotive Industry Development Centre (AIDC), which has given the project freedom to use the latest technology associated with alternative energy utilisation.

The team has successfully participated in the 2012 SASC and is now in the design stages of the 2nd Generation vehicle for the scheduled 2014 SASC event.

SIGNAL SPD FOR VIDEO SURVEILLANCE SYSTEMS

COPA's new COP903 is a surge protection device for coaxial cable-connected systems such as video surveillance systems and similar equipment. This unit also protects the 12V DC voltage supplied from the power supply to the cameras. The SPD is DIN rail mountable which makes for a neat installation into 19" racking systems. COPA is represented locally by Surgetek.

WATTSUP

WITS ALUMNI RECEIVE THE COUNTRY'S HIGHEST HONOUR

Wits University would like to congratulate the following three of its alumni who have been awarded National Orders by the President: Prof. Glenda Gray, Dr Ridwan Mia and Dr Bernie Fanaroff.

PROF. GLENDA GRAY was awarded the Order Mapungubwe (Silver) for her life-saving research in mother-to-child transmission of HIV and AIDS which has changed the lives of people in South Africa and abroad. Her work has not only saved the lives of many children, but also improved the quality of life for many others with HIV and AIDS.

Gray is the Director and founder member of the Wits-affiliated Perinatal HIV Research Unit (PHRU) at Chris Hani Baragwanath Hospital in Soweto, which has achieved international recognition for its research and results. In 2002, the PHRU estimated that approximately 1,400 babies became infected. Now, with effective roll out of PMTCT interventions and optimizing antiretroviral prophylaxis, less than 500 babies acquire HIV from their mothers in Soweto per annum.

Every unit is only as strong as its leader, and Gray has demonstrated an exceptional ability to collaborate with other investigators in multicentre trials. *"Our unit is strong because our scientists are passionate about understanding HIV, sharing our findings and making a difference in the world. This award is a great honour, and I'd like to accept it on behalf of the community of dedicated clinicians, scientists and researchers who work with me, and who share the vision that eliminating paediatric HIV is realisable and achievable!"*

DR RIDWAN MIA was awarded the Order of the Baobab (Silver) for his excellent contribution to the field of medicine and for giving hope to victims devastated by burn injuries.

Mia recently made history when he and a team of doctors saved three-year-old burn victim Pippie Kruger's life by transplanting skin cloned from her own cells in a lab in Boston in the US. The medical team led by Mia performed the surgery on 11 June 2012 in the Garden City Hospital, making it the first reconstructive surgery where cloned skin was used in Africa.

STAFF APPOINTMENT AT ENERGY CYBERNETICS

Frikkie Malan has been appointed to the position of Director for Operations at Energy Cybernetics.

DR BERNIE FANAROFF, who led South Africa's bid to host the Square Kilometre Array (SKA), was awarded the Order of Mapungubwe (Silver) in recognition of his excellent contribution to astronomy and his dedication in putting South Africa on the map. He is a thinker, an academic, a trade unionist and an exceptional public servant.

Upon receiving news of the award, Dr Fanaroff said: *"From the beginning, South Africa's SKA Bid was a combined effort of the SKA Bid Team, the Department of Science and Technology, the National Research Foundation and other stakeholders. Contributions made by team members both past and present were key in ensuring the success of our bid and credit cannot go to any single individual. From the co-operation we received from role-players from the outset, to the various managers, engineers, consultants and volunteers involved in the SKA Bid, we can all stand proud for what we have achieved, not only for Africa but for astronomy as a whole. The honour of my nomination being accepted by the President is indeed an enormous one and is reflective of the team effort that has gone into bidding for the SKA."*

PRESIDENTIAL VISIT TO THE SAIEE SOUTHERN CAPE CENTRE

SAIEE President 2013 - Paul van Niekerk, SAIEE Student Liason - Ikho Bambiso, ECSA Committee member - Ken Ramjee

Anelisa Kani, Mzikazi Hani, Paul van Niekerk and Zine Siway

SAIEE President, Paul van Niekerk enjoyed his visit to the Southern Cape Centre recently. He visited the Nelson Mandela Metropolitan University (NMMU) and were introduced to Engineering students, who will (hopefully) be SAIEE members in the near future. Seen here in the photographs, Paul enjoyed getting to know a few of the students.

TAKING A DIGITAL SPIN ON THE AUTOBAHN WITH OPEL

Ryan McManus
Executive Creator Director
NATIVE

Ever dreamt about driving on Germany's Autobahn - no speed limits, just freedom? Well NATIVE decided to take this fantasy and make it a virtual reality with the launch of Opel's new Astra & Astra OPC.

The campaign features a number of components that include an engaging racing game on Facebook called Wir Leben Autobahn, where users get to drive a virtual Opel vehicle on a Google Maps version of the Autobahn. Participants are ranked and the top 50 driving times will win an opportunity to test out their real world driving skills at the Opel Academy. The top two finishers will win a trip to the Nürburgring in Germany.

"It's a fun and innovative concept that challenges a dedicated audience of gamers and grows overall interest in the new Opel models. To date we had over 2 100 visits to the game while 92% of visitors opened and viewed the new Opel Astra commercial," says Ryan McManus, Executive Creator Director at NATIVE.

The Wir Leben Autobahn Game will continue for three months, after which the winners will be selected and the next stage of the competition will kick in.

BENCHMARKING ENERGY USE CREATES AWARENESS AT EXXARO

Ernst Venter, Exxaro's executive head for growth, technology and services

By being one of the top performers in the National Energy Barometer Survey for the 2011 utility year, Exxaro has received confirmation that its buildings' energy efficiency investments are paying off when compared to others in the same sector.

After participating in every National Energy Barometer Survey since its inception, Exxaro is for the second consecutive year runner up in the Head Office & Corporate Offices category, with winners Central Energy Fund (CEF) House, and in third place Anglo Gold Ashanti. Categories assessed in the 2011 survey included Head Offices, Hospitals, Hotels, and Motor Car Dealers, but due to non-disclosure agreements not all winners in all categories may be announced.

When asked why Exxaro uses the National Energy Barometer Survey benchmarking adjudication process, Ernst Venter, Exxaro's executive head for growth, technology and services, says, *"It allows us to compare our building to others in the industry, and it is very encouraging to know that a 50 year old building fares well against green build buildings, and other more recently built and upgraded facilities."*

WATTSUP

EML MOTORS DRIVE COST EFFECTIVE PRODUCTIVITY

The current economic climate has forced businesses to find creative ways of reducing their expenditure, without compromising quality. This interesting dilemma has resulted in a mindset shift that encapsulates sourcing alternative products from reliable and well-established suppliers. EML, a division of Zest Electric Motors and part of the Zest WEG Group, provides its customers with a cost effective range of motors for a variety of industries.

There is a real need in industry for businesses to deal with a reputable supplier that offers quality motors with a high level of support. Maximising production and minimising downtime remain predominating factors for industry. EML motors have found great acceptance in industry because of their high levels of uptime when driving plant and equipment.

"EML Motors' core focus is the supply of a cost-effective range of cast iron electric motors that conform to the major, acceptable quality standards. This range of motors, sourced from a quality certified manufacturer in Nantong, China complies with the European CE mark, SABS-SANS 1804-1&2:2007, Part I: IEC requirements and Part II: Low Voltage Three Phase Standard Motors," says Gavin Toms, from EML.

"The motors are manufactured in an ISO certified facility that prescribes to stringent quality controls. The resultant products are robust in construction. Manufactured from cast iron, with cast integral feet, they are designed to improve the heat exchange and to provide enough mechanical strength for operation in harsh environments. All motors in the range are rated to IP 55 in their standard configuration and can also be modified to IP 56 and IP 65 ratings, to facilitate use in environments that dictate this level of ingress protection," adds Toms.

A large facility near Johannesburg offers a substantial stockholding of the full range of EML motors. In addition to this ex stock option, a countrywide network of branches acts as a comprehensive support system for this facility. *"Individual customer requirements are catered for by our experienced and knowledgeable team of sales engineers, who are equipped to assess application-specific idiosyncrasies,"* Toms concludes.

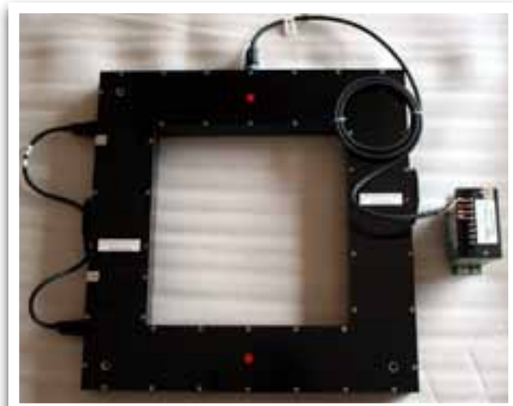
Gavin Toms, EML branch manager, and Ryk van Schoor, EML internal sales.

EML motors are essentially a plug and play solution.

HIGH CURRENT HALL EFFECT CURRENT SENSORS

The CTL/CTA range of Hall effect DC current transducers is available in current ranges of up to 40kA. The illustration shows a 30kA unit with split core for easy installation over busbars of up to 330mm x 330mm. When combined with a signal conditioner Model CTA, provision can be made for outputs of ±10V, 4-20mA, ±5V or ±1mA. Accuracy is ±1% at full scale and can be used in temperatures of up to +65˚C.

Typical applications will include DC arc furnaces, chlorine production and electro-winning of copper, zinc, platinum, etc, i.e. all electro-chemical and electro-metallurgical processes. Products are available from Denver Technical Products (Pty) Ltd.



CESA TO ASSIST WITH SIP7

Thabo Mokwena, SIP7 (seventh Strategic Integrated Project) Coordinator and Guest speaker at the CESA Gauteng Presidential function, made an impassioned plea for CESA members to work together with PRASA to assist with the lack of capacity at Municipal level.

He stated that CESA needs to work closely with PRASA and support the 12 identified municipalities to roll out projects. Last year CESA and PRASA signed an MOU to take the process forward.

Mokwena discussed the Polokwane Rapid Bus Transit System which are struggling to get the planning on track and appealed to CESA member firms to roll up their sleeves and get down to business to get the project on track'. Mokwena appealed to the audience in saying, *"Capacity needs are there and they are serious"*. He cited the R5billion ITS system for Buffalo City Municipality has been held up with court proceedings for the past 3 years and shows no sign of getting off the ground for another 2 years. He reiterated that it is the responsibility of CESA and its member firms to actively assist in unlocking projects.

CESA President Naren Bhojaram and Thabo Mokwena, SIP7 Coordonator

Mokwena particularly appealed to CESA to assist with the planning phases of projects. *"Simple input on simple lives are the projects that I'm interested in"*. Mokwena believes that of the trillions allocated by Government to infrastructure development mostly will go out of the country as most (approximately 80%) of the money will be spent on technology. He said that the debate around technology is the most important issue and that it is important for South Africa to start technology industries to ensure the sustainability of the country.

CALL FOR PAPERS ISSUED FOR SUB-SAHARA'S PREMIER POWER CONFERENCE

PennWell Corporation has issued a call for papers for POWER-GEN Africa 2014, the leading international conference for the power sector in sub-Saharan Africa.

Following the success of the inaugural POWER-GEN Africa conference in 2012, which saw 228 conference addresses over three days with over 2,000 attendees, POWER-GEN Africa 2014 will again focus at a high level on the key issues impacting the region's power generation stakeholders.

POWER-GEN Africa 2014, to be staged in Cape Town, South Africa, from 17-19 March 2014, will address local and international experts and professionals from energy intensive industries, and officials and ministers from the national and regional political spheres who are tasked with energy policy.

The three day event will also feature a multi-track conference to explore the theme Solutions for Africa's Energy Future and an exhibition where the leading suppliers from both the international and African power sectors will demonstrate their latest technologies and solutions to a power-hungry audience. The second POWER-GEN Africa will take place in tandem with DistribuTECH Africa in Cape Town, and is expected to again attract large numbers of attendees from across Africa.

At the inaugural event, 63 countries from 6 continents were represented. A dominant 66% of the conference and exhibition attendees were from across Africa. 93% of attendees said they found POWER-GEN Africa important to achieving their business objectives, and 100% of attendees surveyed said POWER-GEN Africa fulfilled their expectations.

The 2014 conference and exhibition will focus both on conventional power generation and the rapidly emerging alternative power generation sector.

Over three tracks: Strategic, Technical and Renewable Energy, POWER-GEN Africa will provide a platform for expert insights into strategies, trends and technologies to drive the sub-Saharan power sector.

A POWER-GEN Africa Best Paper Award will be given for the most interesting, relevant and innovative paper in each POWER-GEN Africa conference track as judged by members of the Conference Advisory Board.

The expert speakers selected by the advisory board will deliver advanced papers to an audience of power and heat producers and plant owners, public sector power officials, strategic investors, engineers, traders and trade media, among others.

For further information visit www.distributechafrica.com

WATTSUP

GPUK APPOINTS DAVID WILKINSON TO MANAGE NEW AUTOMATION SUPPORT TEAM

David Wilkinson, GEA

GEA Process Engineering Ltd has appointed David Wilkinson as Automation Service Manager to establish and develop a new service team supporting GEA automation control systems throughout the United Kingdom.

David has over 14 years' experience in the industry having worked for some of the world's leading control systems manufacturers including Honeywell, Siemens and Rockwell Automation.

"We are in the process of building a team of highly qualified engineers with a broad spectrum of experience who can support all systems, not just GEA installed systems," said David. *"Our aim is to provide an independent 24/7 service to manufacturing businesses, especially those who may find it too expensive to employ their own full-time support staff."*

6TH ROBOTICS AND MECHATRONICS CONFERENCE OF SOUTH AFRICA - CALL FOR PAPERS

The Robotics and Mechatronics Symposium provides a platform to showcase and gauge the current state of advanced robotics and mechatronics research in South Africa. Research facilities in southern Africa and beyond are invited to present and share their work. The symposium is open to all industries, research institutions and hobbyists. The symposium brings together researchers, academicians, application engineers, users and policy makers of CAD/CAM, robotics and factory automation.

PAPER SUBMISSION AND PRESENTATION

The official language of the Conference is English. Participants are requested to submit their papers in English in a PDF format. Use the standard IEEE format, A4, 2 columns limited to 6 pages. Templates are at http://www.ieee.org/conferences_events/conferences/publishing/templates.html.

The closing date for receipt of full papers for review is 31 July 2013. Early submissions are encouraged, to allow for early evaluation and potentially for preferential acceptance. Reviews will be sent to the author by 31 August 2013. The closing date for receipt of final papers for inclusion in the symposium Proceedings is 20 September 2013. Only papers by fully-registered and paid-for delegates will be included in the Proceedings. For more info visit www.robmech.co.za.

John Edmeston, Managing Director of Cartrack

LATEST TECHNOLOGY IN GLOBAL MONITORING

Cartrack's new Fleet Sat offering challenges the perception that satellite products are expensive, by providing a cost effective global monitoring solution that is tailored to your specific fleet requirements.

Fleet Sat is ideally suited to transporters who operate across the length and breadth of Africa. *"The solution is satellite based, which solves the challenges that cellular technology faces in African countries such as unavailable or unreliable networks, not to mention expensive roaming charges. Fleet Sat is perfect for the positioning of vehicles or assets which operate outside any GSM network,"* says John Edmeston, Managing Director of Cartrack, a market-leading vehicle tracking and recovery, fleet management and telematics service provider.

The Cartrack Fleet Sat offering is able to pinpoint vehicles or assets via satellite technology, anywhere in the world. *"There are no costly international roaming cellular rates and the solution is operated using a web-based application, with detailed mapping and trip history reporting, that is hosted in the cloud and accessible from any device that has internet connectivity"* concludes Edmeston.

CONSUMER RESPONSE TO POWER CONSERVATION

Veer Ramnarain, SAIEE Chairman KZN Centre with SAIEE Junior Vice President, TC Madikane who is also immediate past Chairman, KZN Centre.

In January 2008 the South African power grid became severely constrained because electricity demand exceeded supply. The immediate correction was load shedding. Later, Eskom promoted a medium term strategy of power conservation to encourage consumers to reduce their power usage so that overall demand could be managed. Despite the extensive campaigns, the 10% electricity savings target was not met in 2008.

A study to review the experiences of other countries that had successfully implemented power conservation programmes and to research the different approaches that were taken in other countries to encourage consumer behavior change. A survey and quantitative analysis was undertaken on a sample of electricity consumers within the eThekwini Municipality Central Region. The purpose of the study was to gauge the response of consumers to the power conservation campaigns conducted within the municipality. The analysis was done to determine how the response had varied among the various groups by taking into account demographic factors like age, gender and income level. The population of the sample frame was estimated at 15,000 customers. Two hundred and eighty responses were received and analyzed. The results were encouraging.

Specific recommendations were made on the future strategy to be followed in South Africa to encourage consumers to save electricity. The main recommendations were that Government should lead the savings drive, with customised campaigns for different demographic groups.

The campaigns should place greater emphasis on the financial benefits to be gained. It was necessary for new and different savings measures to be communicated, and finally that Government should introduce legislation to enforce electricity savings.

A SHORT PROFILE: VEER N. RAMNARAIN

Veer joined eThekwini in 2009 and is employed as Deputy Head of Electricity. He started his career at Siemens as a design engineer and later continued with Eskom in various positions. He spent 13 years at Eskom and gained experience in the areas of Power Transmission, Power Distribution and Power Generation; working at the Drakensberg Peaking Hydro and Majuba Thermal Power Stations.

Veer's qualifications include a BSc Electrical Engineering Degree from the UKZN, a Diploma in Engineering Business Management from the University of Warwick and an MBA from the Graduate School of Business at UKZN.

He is a Registered Profession Engineer, possesses a Government Certificate of Competency and is a Senior Member of South African Institute of Electrical Engineers.

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WATTSUP

ACTOM AND ALSTOM SIGN TRANSMISSION TECHNOLOGIES COOPERATION AGREEMENT

ACTOM, the largest electrical engineering group in Southern Africa, and Alstom Grid, world-leading provider of engineered solutions and products for smart and conventional power grids, signed a three-year transmission technologies cooperation agreement in Johannesburg on April 23.

The agreement, effective until April 2015, was signed by Jack Rowan, Chairman of Transmission & Distribution at ACTOM, and Eric Boulot, Alstom Grid's Commercial Vice-President for Southern Europe and Africa.

Said Rowan: *"The agreement represents the continuation of a longstanding mutually beneficial cooperative association between the two groups. ACTOM's focus has always been on maximising local content and we manufacture a number of products under licence to our international partners wherever this proves practicable, in addition to developing and manufacturing products of our own."*

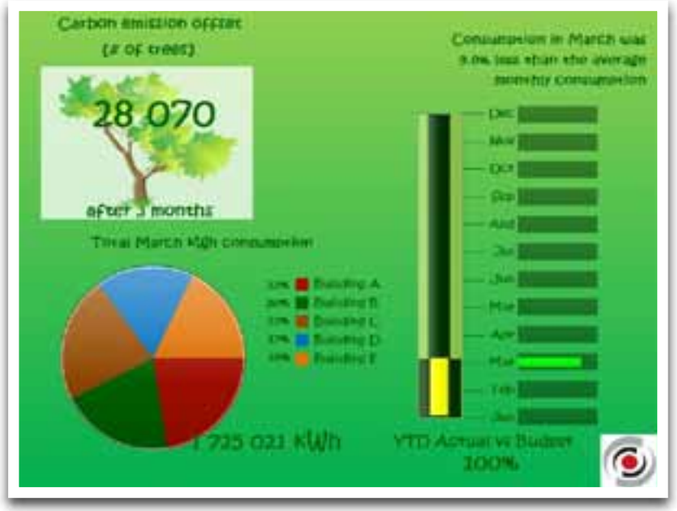
Boulot stated: *"Alstom and ACTOM are partners in a number of activities such as signalling, boiler services and Metro coaches in the region and this agreement will reinforce the partnership and cooperation between the two groups. The renewal of the agreement has been a perfect time to review our operations together and to energise our approach to the market. We share a clear ambition to be at customers' side when they engage in challenging programmes such as implementing smart grid solutions to manage newly installed renewable power generation and to manage the transmission network more efficiently."*

Eric Boulot (left) of Alstom Grid and Jack Rowan of ALSTOM T&D shake hands after signing the final agreement formalising the partnership between the two groups. Looking on are ACTOM's Group CEO and Chairman Mark Wilson and Group Executive Director Andries Tshabalala.

PUBLIC DISPLAY OF ENERGY SAVINGS

Bring your 'behind-the-scenes-energy-savings-efforts' to the front by displaying your performance for all to see with Energy Cybernetics' 'auto-play' dashboard solution. Display how many trees you have saved for a set period, what your carbon emissions are, how your consumption compares to a previous month – parameters can be selected to showcase positive performance, but also give warning of increased pressure on your system allowing an awareness of excessive use.

Energy Cybernetics offers comprehensive energy management reporting and dashboard solutions based on data collected, validated and processed through its locally developed PowerWatch energy management system.



CREATING LIFELONG LEARNERS @ TUT, eMALAHLENI CAMPUS

Marius Dieperink (Head Faculties of Humanities, TUT) with some of the 1st year students and Tjibbe Spoelstra (RHDHV).

Tjibbe Spoelstra (RHDHV), Tharina Stöltz (TUT Lecturer) and Marius Dieperink (Head Faculties of Humanities, TUT).

Students collecting wattnow magazines prior to the lecture.

*THANK YOU **watt**now!!*

Class of 2013 - Electrical Engineering students (1st year, extended programme) were treated to a communication lecture with a difference on the 9th of May.The Buildings Electrical & Electronic - Business Unit Leader, Mr. Tjibbe Spoelstra (Pr Eng.) from the Royal Haskoning DHV provided a practical side to theory as a guest lecturer.

The two hour session gave students insight into engineering practice; *"Where & How do Junior Technicians/ Engineers kick off their career, What would their daily assignments comprise of, How would they be measured in the industry."*

At TUT, first year students are enrolled to also attend service subjects, which are offered by the Faculty of Humanities to the Faculty of Engineering.

"We are committed to teaching and learning – that is why we invest in our future, by creating a mind-set of lifelong learning", said Mrs Tharina Stols, Lecturer - Department of Applied Languages.

She indicated that by offering interactive sessions, like having a guest lecture, the students minds are opened to the importance of a formal qualification.

This serves as an additional motivation for them to persevere and to utilize the opportunity given to them at TUT. She said it also provides them with an opportunity to learn from knowledgeable practitioners and mentors in the engineering industry. At TUT, eMalahleni Campus, lecturers are committed to give students as much industry exposure as possible.

The session was concluded with a discussion of an innovative project by Royal Haskoning DHV a *"Solar High Mast Lighting project"*. Philips provided a sample of their latest flood light for the discussion session. In addition, Philips supplied each student with marketing merchandise. **watt**now Magazine provided each student with the May issue as well as back issues.

This combined effort will definitely add excitement to the students learning environment. Based on the lecture and the topics covered, the students have been assigned a Portfolio Assignment on the lecture, which they have to hand in as part of their final year mark.

Watch this space for innovation in lecture rooms at TUT eMalahleni Campus!

Enterprise Learning to the next level & address Skills Gaps

5 learning trends that will shape the workplace in the coming year

BY I GAVIN OLIVIER **I** PARTNER AND MANAGING DIRECTOR **I** LRMG

Merely recruiting to fill a skills gap within organisations is no longer the whole answer. The true, and complete, answer lies in recruiting the right people and developing them through learning. Critical workforce needs and advances in technology mean that learning professionals are at the forefront of the most important talent challenges.

Learning can be a major driver of revenue for an organisation and serves as a great motivator for staff and increases productivity and retention. Technology-driven learning, if applied correctly, is flexible, adaptable and cost-effective and more immediate.

Here are five technology trends which companies should leverage to unlock business opportunities that will shape workplace learning in the year ahead:

TREND #1: INTEGRATION OF DATA IS ESSENTIAL TO ANALYTICS

There are basically two trends that go hand-in-hand - rapid integration in the market and the almost exponential growth of workforce data. Data consolidation has been activated as companies are creating an integrated talent management approach, with learning connected to performance, compensation, succession and recruiting. Organisations with effective integration of learning and talent systems are three times more likely to have strong business results. Companies are drawn by the Return on Investment (ROI) potential and another benefit of integration is data that improves workforce analytics.

Integration of talent and learning with other business software can yield insights about a workforce that could lower human resource costs and, ultimately, benefit the bottom line.

TREND #2: MOBILE LEARNING IS HERE TO STAY AND SHOULD BE EMBRACED

Mobile learning is part of an enterprise-wide movement and because of that it's never been easier to engage staff on the job, or on the go. A recent survey by the International Data Group (IDG) indicated that 69% of chief information officers worldwide placed mobile technology adoption at the top of their list of critical priorities for 2013. Organisations embrace mobile learning as a great way to increase participation and engagement. For example, leveraging one of the most basic elements of mobile technology - text messages (SMS) - learners can be encouraged to participate in polls, surveys and questionnaires. More engaged learners means more effective training.

There are several other ways companies can leverage mobile learning, including providing job aids and quality operating procedure updates to employees who, for example, don't have access to a workstation or are out in the field away from their workstations. Mobile technology allows for immediate access to information - whether it's technical specifications, learning and training resources or current marketing collateral - no matter where staff are based.

TREND #3: RAPID CONTENT CREATION

Solutions that are quick, inexpensive, simple to create and easy to deploy are must-haves for those generating e-learning content. One emerging trend is to integrate social media and social learning into e-learning courses, for example, by embedding a link such as a blog, into a course. Other trends include more scenario-based learning and creating shorter courses of around five to 15 minutes, instead of the traditional 30- to 60-minute courses.

TREND #4: TURN LEARNING INTO A DIRECT REVENUE-GENERATOR

The 'holy grail' of learning outcomes is cutting costs, increasing efficiency and driving revenues. One way to contribute to all three is by adopting extended-enterprise technologies and serving external audiences such as distributors, suppliers, customers and more. Software as a Service-based learning management systems make it easy to develop and deliver training

Gavin Olivier I partner and Managing Director I LRMG

on demand, helping organisations to accelerate the adoption of new products and services, improve information-sharing with external partners, improve customer satisfaction and increase sales by supporting sales-enablement.

TREND #5: USE DEVELOPMENT TO DRIVE TALENT RETENTION

Research shows that 45 to 50% of top performers within a company are always looking for new jobs that bring new challenges. Recruiting is again, not the solution. Retention is. Succession management tools to help companies assess which roles are critical to their success and identify skills gaps. Once there is an understanding of the bench strength and areas of risk, organisations can target development for high-potential employees in these areas.

In conclusion, it's crucial that employees are active participants in their career development and that organisations provide the right training to help them gain the knowledge and skills to become the drivers of the business as tomorrow's leaders. Empowering employees with the tools to impact their own learning and career development is going to remain a growing trend in the market. wn

Stan Wilson (CBI), Chris Greager (CEO, ECA) and Dirk Engelbrecht (President ECA)

What is happening about safety in the electrical industry?

At a press conference held in Johannesburg on the 30th April, the President of the Electrical Contractors' Association ECA (SA), Dirk Engelbrecht stated that the ECA (SA) is extremely concerned about the lack of interest or control the Department of Labour appears to have over the Industry, despite its being responsible for enforcing the legislation which controls it.

We are also concerned about the failure of the National Regulator for Compulsory Specifications (NRCS) to carry out its mandate of ensuring that all electrical components comply with the relevant safety standards".

"It is our intention today to make public what is going on in the Industry, and why the ECA (SA) is concerned about the lack of policing or controls". He further re-iterated that unless the Department of Labour takes its duties seriously there will rapidly be a deterioration of standards, and the safety and welfare of people and properties will be compromised.

On 4 March 2013 ECA(SA)'s National Director, Chris Greager, addressed an e-mail letter to the Department of Labour's (DoL) Chief Inspector, Thobile Lamati, and two of his senior staff requesting a meeting to discuss ten matters of concern to the Electrical Contracting Industry. To date, the request still remains unanswered.

The ten unanswered questions to the Department of Labour were -

1. LACK OF POLICING

The total lack of policing in the Industry, particularly with regard to unregistered electrical contractors, shoddy and dangerous workmanship, and the issuing of invalid electrical certificates of compliance/ test reports by some electrical contractors.

2. APPROVED INSPECTION AUTHORITIES

The ECA (SA) requires clarification about Approved Inspection Authorities (AIAs). It had informed the DoL in the past of its support for AIAs, but wished to know how many had been accredited to date by the South African National Accreditation System (SANAS); how many had been approved by the Department in terms of regulation 3(1) of the Electrical Installation Regulations; and who they were. It indicated that it would like to work more closely with the AIAs when dealing with complaints from users, but as far as it could ascertain there are only two or three in the whole of South Africa which rather defeats the object of their existence.

3. CORRECT COMPLAINT PROCEDURES

The ECA wishes to establish the correct procedures to be followed when it or members of the public wish to lodge complaints about dangerous or illegal electrical installations, unregistered electrical contractors, etc.

4. PROCEDURES FOR AIAS

The ECA (SA) wishes to establish the correct procedures that should be followed by the AIAs, and to whom they are accountable.

5. LIMITATIONS OF AIAS

The ECA (SA) also wishes to establish whether individual AIAs are limited by their registration as *"registered persons"; ie.* can an AIA with only an installation electrician in its employ, inspect, test and pass comment upon installations in hazardous and/or explosive locations despite the fact that only master installation electricians are registered to carry out such work?

6. REGISTRATION OF ELECTRICAL CONTRACTORS

On 1 September 2012 the Department of Labour took over the annual registration of electrical contractors from the Electrical Contracting Board of South Africa (ECB) which had been carrying out such function on behalf of the Chief Inspector since 1993.

Since then numerous complaints have been received from electrical contractors about the registration process at some of the DoL's provincial offices.

7. ASSISTANCE WITH REGISTRATIONS

In order to assist in the registration process, the ECA (SA) proposed entering into an agreement of co-operation with the DoL to use the Association's seven regional offices as "post offices" to accept electrical contractors' registration documentation and to submit it to the DoL's offices for their necessary attention.

8. ACCESS TO DATABASE

The ECA (SA) has requested access to the data base of registered electrical contractors. It receives many enquiries from municipalities, the National Bargaining Council for the Electrical Industry, estate agents and the general public asking whether certain businesses are registered.

In the past, it was able to access this information but can no longer do so. *"How is an average South African able to check the credentials of their electrical contractor and be assured that he is legitimate and properly registered to enable him to carry out any electrical installation work on their properties?"* asks Greager.

9. PERIODS OF REGISTRATION

It appears that most of the Department's Provincial offices are allowing electrical contractors to register for three years at a time, and there are other examples where contractors have been registered for up to seven years. Regulation 6(2) of the Electrical Installation Regulations prescribes "annual registration", so the ECA (SA) is puzzled why this requirement is being ignored.

10. CERTIFICATES OF COMPLIANCE FOR ELECTRIC FENCES

Finally, the ECA (SA) expressed the need to discuss the requirement in terms of regulation 12(4) of the Electrical Machinery Regulations, which came into effect on 1 October 2012, that the user or lessor of an electric fence shall have a certificate of compliance for a new fence, when any addition or alteration is effected to the fence, or when there is a change of ownership of the premises. The ECA says its supports this requirement, but that training to undertake the necessary skills programme is not currently available countrywide.

"We need answers and we need progress on all of the issues that have started and fizzled without resolve. Everyday electrical installation work is being carried out in thousands of South African homes, offices and factories, but little attention is being given to controlling illegal operators, or in taking action against those who perform dangerous and shoddy work and which is a threat to life and property" says Greager.

FAILURE OF NRCS TO EXECUTE ITS FUNCTION

In addition to this, Greager states that the National Regulator for Compulsory Specifications (NRCS) is failing to effectively execute its functions. The main objective of the NRCS in terms of the Act is to make recommendations to the Minister of Trade and Industry on compulsory specifications; to administer and maintain compulsory specifications; to carry out market surveillance through inspections in order to monitor compliance; and to enforce compliance.

Regretfully it appears that the NRCS is failing to discharge its duties as many non-compliant and potentially dangerous electrical components are getting into the market, and as a result placing innocent electrical contractors and property owners at risk. wn

City of Joburg Broadband Network goes Live

The City of Joburg Broadband Project will go live on 1 July 2013 after a 3 year build phase, which BWired will operate for 12 years.

The completion of the fibre optic network covers all 7 regions of the City of Johannesburg (CoJ) municipality, and will deliver a live network that will immediately be able to offer key services to all municipal buildings connected to the network. This fibre optic network was designed by Ericsson South Africa and uses world class leading technologies utilized in Smart Cities around the world, and marks one of the biggest rollouts of its kind in the Southern Hemisphere in terms of its 1.2Tb core capacity and 940km coverage, giving the City of Johannesburg true Smart City Status.

The Johannesburg Broadband and Network Project (JBNP) is the realisation of the city's long term vision of developing the city's economy which will see the positive stimulation of opportunities for the business sector in terms of small to medium enterprises, effective access to public services, the development of the youth in Johannesburg and increased employment opportunities for all.

All civil work was completed at the end of April 2013, with the fibre installation work being at 90% completion at this time. The network build will be completed at the end of May 2013. When the Network goes live on the 1st July 2013, it will offer full WAN accessibility, VPN services, and will bring internet to all of the CoJ buildings in the region. The JBNP will be service ready to transition all of the agreed upon services as of 1 July 2013.

"We support the vision of the CoJ, and the completion of this successful build phase on time and within budget, is testament to our commitment to the project and its objectives," said Musa Nkosi, BWired CEO. The network was developed by the CoJ in partnership with Ericsson, with the aim of creating a platform for bridging the digital divide within the CoJ. The delivery of the network will allow the CoJ to assume Smart City status, which is supported by a strong broadband backbone. The benefits of broadband to any city are far-reaching – including economic growth, the enhancement of the public service offering through e-government, added capacity and efficiencies for private enterprises, social benefits through e-learning, job creation through community portals, and right though to city wide platforms for emergency services.

"The principle behind this network was to provide ICT communications at a vastly lower cost, not only reducing the CoJ's communications costs, but enabling the rest of the residents of the city to benefit from the network roll out," said Nkosi. Although connecting all of its buildings, the CoJ will only use a small percentage of the projected network capacity, meaning other telecoms service providers, and industry at large can plug into the remaining capacity on a wholesale and open access basis. *"We are already working with one of country's largest mobile service providers with over 200 sites connected and operational to date. We are also running a number of POC's with Tier 1 ISP's, as well as other network Operators. This shows how BWired is extending its network's functionality beyond the CoJ Municipality requirements and realising true inclusion for all within the City of Johannesburg,"* added Nkosi.

The CoJ Broadband Project will enable digital inclusion through the provision of affordable broadband to the public. wn

If the future could choose: Cost-effective hydrogen electrolysers into South Africa

As an increasing number of countries worldwide make major commitments to the use of hydrogen for vehicles, awareness of its benefits are coming to the fore. To date, the biggest challenge in South Africa has been the availability of a cost-effective small hydrogen pressure electrolyser. Tshwane-based Rand Technical Services (RTS) has solved this problem with the introduction of the NEL P-60 unit.

"RTS is a great proponent of the advantages that can be derived by adopting hydrogen technology. However, until recently, the cost factor around providing a smaller unit was not feasible locally."

NEL Hydrogen recognised the challenges around developing a small hydrogen electrolyser that would be affordable enough for a mass market. Research into what later became the NEL P-60 commenced in earnest.

During his recent visit to South Africa to introduce the NEL P-60 unit to RTS' client base, Eric Dabe, NEL Hydrogen Regional Sales Director, pointed out that an affordable hydrogen car could very well be a reality by 2016. *"We are already seeing the growing popularity of the beta model hydrogen golf carts. We envisage that there will be a market for purely electric (battery-driven) vehicles, complemented by a market for hydrogen fuel cell powered vehicles. Since electric cars can only run for shorter distances, the hydrogen vehicles could be very useful for long-distance commuting. In effect, the electric cars become town cars while the hydrogen cars become extra-urban vehicles, capable of travelling distances of up to 700 km.*

Ian Fraser
Chairman
Rand Technical Services

Dynamic Spectrum Access (DSA)

Why DSA and what's the Benefits?

Radio spectrum is a natural resource whose utilisation is subject to regulations and policies by government agencies at both international and national levels. The purpose of these regulations and policies is to manage this natural resource for the maximum possible benefits of the public.

BY | JIDE JULIUS POPOOLA **|** REX VAN OLST
SCHOOL OF ELECTRICAL & INFORMATION ENGINEERING
UNIVERSITY OF WITWATERSRAND

By its nature radio spectrum is renewable; however usable radio spectrum is limited by the constraints of the current fixed radio spectrum allocation policy which makes decisions about how the radio spectrum will be allocated and who will have access to it. As a direct result of the rigid nature of this existing fixed radio spectrum allocation, research in dynamic spectrum access (DSA) has accelerated. Dynamic spectrum access (DSA) is a set of techniques based on theoretical concepts in network information theory and game theory that is being researched and developed to improve the performance of a communication network as a whole.

Figure 1 shows the components and data flows in Dynamic Spectrum Access [8]. The reasons for this research into DSA are two-fold. The first reason is a result of the recent developments in wireless industries that have led to a dramatic increase in demand for and usage of radio spectrum. The second is as a result of the imbalance that the current radio spectrum allocation policy has created between radio spectrum scarcity and radio spectrum under-utilisation. This is because a significant amount of licensed radio spectrum is sporadically used [1].

For example, a typical radio spectrum measurement carried out by the Enforcement Bureau of Federal Communications Commission (FCC) at Atlanta, Chicago and other parts of the United States, as

Dynamic Spectrum Access (DSA)

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reported by [2], shows that only 5–10% of the licensed spectrum is used on average.

In a similar measurement carried out by the Independent Communications Authority of South Africa (ICASA) for the 790–862 MHz licensed spectrum carried out in Port Elizabeth, Johannesburg, Bloemfontein, Durban, Cape Town and Pretoria in March 2009 reported in [3] revealed that 99.74%, 99.84%, 99.97%, 98.58%, 98.59% and 99.36% are the percentages of inactive frequencies respectively in those locations. A similar actual measurement also carried out in 2010 reported in [3] for 450–470 MHz by ICASA in Port Elizabeth, Johannesburg, Bloemfontein, Durban and Cape Town showed that 0.37%, 2.0%, 1.75%, 0.81%, 0.67% and 0.67% are the respective percentages of the active licensed frequencies in those locations at any time.

These series of measurements show that scarcity of usable radio frequencies for wireless communications is not as a result of a lack of radio spectrum but more likely as a result of the current inefficient fixed radio spectrum allocation policy. An effort to alleviate the radio spectrum scarcity as well as improving radio spectrum utilisation

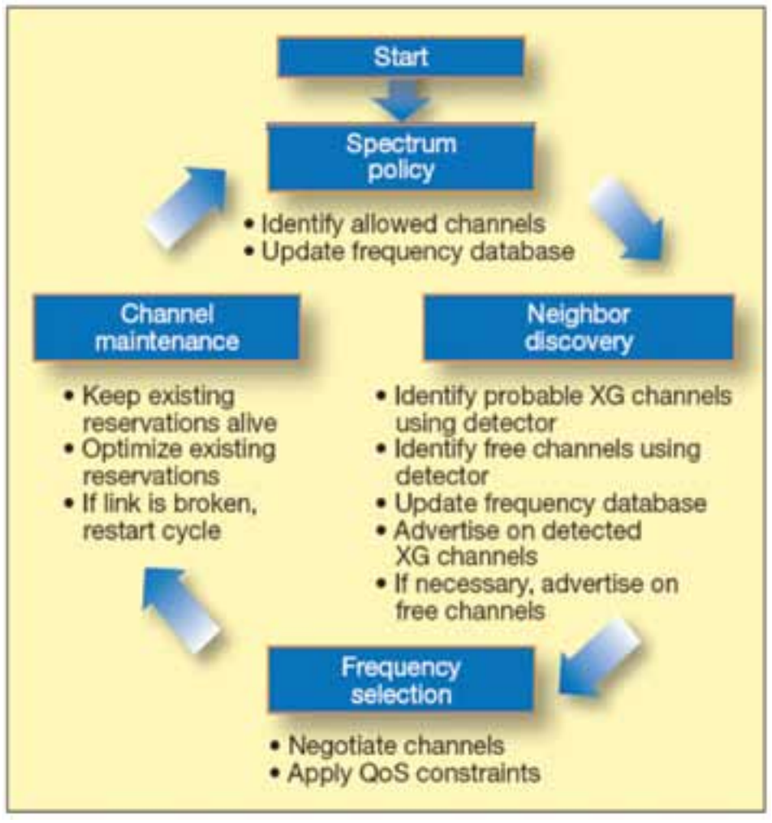

Fig 1: The components and data flows of Dynamic Spectrum Access [8]

introduces the concept of communications systems that can exploit the unused portions of the licensed spectrum, also known as "spectrum holes" or "white spaces". The radio technology that has this capability is known as Cognitive Radio (CR). CR is a radio system that can adaptively and dynamically allow users to access radio spectrum in an opportunistic manner by switching amongst unused portions of the licensed spectrum or spectrum holes at different time intervals. This opportunistic radio spectrum access strategy is called Opportunistic Spectrum Access (OSA) or Dynamic Spectrum Access (DSA) [4].

DSA as an important application associated with Cognitive Radio, is basically a radio spectrum access strategy that allows the unlicensed or secondary user to share, in an opportunistic manner, unused portions of the radio spectrum already allocated to the primary user. In this way radio spectrum efficiency and utilisation is increased.

Dynamic Spectrum Access according to [5] is defined as "the real-time adjustment of spectrum utilization in response to changing circumstances and objectives".

It is therefore a decentralized radio spectrum access strategy that allows a communication device to operate on any unused spectrum. In this new radio spectrum access strategy, unlicensed or secondary users can opportunistically operate in an unused licensed spectrum, as long it does not cause interference to the licensed or primary users. The practice of DSA therefore does follow the following steps:

- Radio environment sensing or monitoring in order to detect the spectrum holes;
- Determination of the frequency band to be used among the detected unused spectrum band or spectrum holes;
- Start communication on the frequency band as decided;
- Continue to monitor the radio spectrum to detect the re-appearance of the licensed (primary) user or other radio activity; and
- Changing of the frequency band and/or transmitter power as the case may be, in order to prevent interference.

This radio spectrum environment sensing or monitoring and the radio resources management can be done either centrally by a single device in a cooperative network or individually by each device in a non-cooperative network.

Recent research has revealed that Dynamic Spectrum Access has significant advantages for both primary and secondary users of the radio spectrum. One of such advantages is its effectiveness in radio spectrum utilisation efficiency.

For instance, the recent developments in spectrum policy and regulation, especially the release of the National Broadband Plan (NBP), the publication of final rules for television white spaces, and the ongoing progress for the secondary use of the 700MHz – 1 GHz band, and the 2.4 GHz band for Smart Grid and Emergency Services applications, according to [6], allows more flexible and efficient use of radio spectrum.

These developments have started yielding results as the presence of Television White Spaces (TVWS) in the European Union (EU) currently present a unique opportunity for providing high-speed Internet access to its citizens [7]. According to these authors, one of the benefits of deploying Super-WiFi in the TVWS compared to conventional WiFi is range extension. For instance a free space loss formula suggests that usage of the 2.4 GHz band allows a maximum transmission range of 250 m.

However, usage of the TVWS band, allows a maximum transmission range of 1.2 km, which according to these authors is a significant range benefit at the maximum sustainable connection rate of 54Mbps.

In addition, the authors also proved that TVWS provides higher capacity and radio coverage than the present network operators' bands of Universal Mobile Telecommunication System (UMTS).

They showed that in the 2 GHz scenario, the coverage probability is 94% with average throughput 15.2 Mbps whereas in the TVWS scenario, the coverage probability increases to 100% with average throughput of 16.9 Mbps, thus providing a significant increase in system capacity. All these benefits are obtained because of the existence of DSA, which leads to radio spectrum availability and more efficient utilisation.

A similar advantage is a recent launching of a TVWS trial with ten schools in the Cape Town area of South Africa. This demonstration is based on TVWS potential to improve internet connectivity in the developing world since signals from the TVWS band are capable of travelling longer distances making the technology well suited to provide low cost connectivity to rural communities with poor telecommunications infrastructure. Thus benefit can also be seen in the expansion of the coverage of wireless broadband in densely populated urban areas as well as opening up access to un-serviced communities in rural areas.

Another benefit of DSA is its ability to enable cost-effective access to preferred or lower frequencies. This cost-effective access is demonstrated in DSA's ability to use free and leased spectrum as well as its capability to use existing radio towers and infrastructures. This enables smaller scale, lower entry costs to become feasible and thus drive down communications services prices.

These lower entry costs increase the introduction of new wireless products and services in the marketplace. Among the method of sharing wireless connectivity presently practiced, for example in the USA, are sharing network facilities, sharing network operations and the sharing of radio spectrum. This cost-effective access methodology provided by DSA does not only improve broadband communication systems but also promotes job opportunities as well as contributing to the nation's economy.

In conclusion, across the world countries are currently migrating from analog to digital technologies and using automatic techniques to replace the manual ones. In the same way, the allocation and management of radio spectrum should not be stationary.

Although the current fixed radio spectrum-allocation policy has served well in the past, today's society is moving at a fast rate towards a mobile wireless society, so a dynamic approach needs to be devised for radio spectrum allocation, access and management.

FEATURE

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With the success recorded so far, it is clear that the adoption of DSA in radio spectrum access and management will not only supplant the present radio spectrum management policies but will also automate radio spectrum management and decision making related to it.

Further, it is also clear that DSA can offer the flexible approaches that are needed to resolve interference without regulatory intervention. Based on the advantages offered by DSA as well as its capabilities, DSA will not only reduce the problems challenging the present fixed radio spectrum allocation policy, it will also not compromise the performance of existing communication services. wn

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LBS market to thrive as focus turns to monetisation

BY QUENTIN JOUBERT **I** CELLFIND

Location based services (LBS) have emerged as one of the hottest growth areas for the worldwide mobile applications and telecommunications industries. Market researcher ABI predicts that the global LBS market will grow to a total value of $17 billion by 2016, thanks to growth in retail applications, advertising, and emerging markets.

Location based services (LBS) have emerged as one of the hottest growth areas for the worldwide mobile applications and telecommunications industries.

Market researcher ABI predicts that the global LBS market will grow to a total value of $17 billion by 2016, thanks to growth in retail applications, advertising, and emerging markets.

We're expecting this market to keep heating up throughout the year ahead, with growing competition driving massive innovation in LBS.

Here are five of the trends we're expecting to see shape the market through 2013 and beyond.

1. FOCUS SHIFTS TO MONETISATION

LBS services are widely available and rapidly growing in popularity for a range of navigation, personal safety and entertainment applications. The user base is growing at a rapid rate, but monetisation of this user base has yet to occur. The major challenge all players in the value chain face over the next couple of years, is turning the traffic LBS generates in revenue.

We can expect players in the market to experiment with a range of 'freemium', subscription and advertising supported models as they look to turn LBS into a profitable business. Call to action services such as roadside and home assist as well as panic-button activated emergency medical services are examples of services that users may see enough value in to be willing to pay for them.

2. OPERATORS TO PROMOTE LBS FOR SUBSCRIBER STICKINESS, HIGHER ARPU

The mobile market is changing rapidly as a result of consumers shifting from voice to data services, lower interconnection rates, and growing price competition. Faced with falling ARPU, South African mobile operators are looking for new ways to bolster their revenues and reduce subscriber churn.

They see enormous potential in LBS as a revenue-boosting class of subscription services or as a value-add that can enhance subscriber loyalty.

Most of them already have some basic LBS services in place, but expect to see them launch new LBS-based products and services - fitness, health, enterprise and other segments are largely untapped - as well as to market them more aggressively in the year ahead.

3. LBS-BASED ADVERTISING ACCELERATING

Consumers are happy to share location data with organisations that they trust. They are willing to receive location-based marketing and advertising - provided that there is some value in it for them. Companies need to tread carefully around privacy issues, but LBS can be an incredibly powerful advertising opportunity.

According to ABI, advertising was less than 30% of the total application store LBS revenues in 2012, but growth is accelerating. Local search and discovery, proximity social networking, and retail are all massive opportunities for LBS-based mobile advertising in the years to come, says ABI.

4. SHAKING UP THE ECOSYSTEM

The navigation ecosystem is complex and competitive – it spans GPS and GIS companies such as Telmap, Garmin and Navteq, mobile operators, large and small application providers from FourSquare through to Google and Yahoo, and mobile device manufacturers (including fitness device, personal navigation device and handset manufacturers).

We see overlap and competition – for example, smartphone mapping apps from the likes of Google are eroding value for the likes of Garmin, while handset manufacturers and application providers are wrestling with mobile operators for control of the customer base.

It's hard to know how this will all play out, but only those that can clearly define their value will thrive in this competitive market.

5. ENTERPRISE LBS APPS MARKET TO EXPLODE

Mobile operators and application providers are looking to the enterprise as the next hot market for LBS. From mobile advertising to asset tracking to transport and logistics, there are a wealth of business applications that can benefit from LBS.

It's an especially attractive market since corporate users will be willing to pay a premium for reliability and accuracy when it comes to apps that allow them to, for example, track assets such as vehicles and equipment, or to manage and deploy field service technicians in the most efficient manner.

Another powerful enterprise app with a lot of potential is using LBS to add another layer of authentication in credit card payments – something which could offer significant benefit to the financial services sector. wn

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Square Kilometre Array (SKA) Lecture in George

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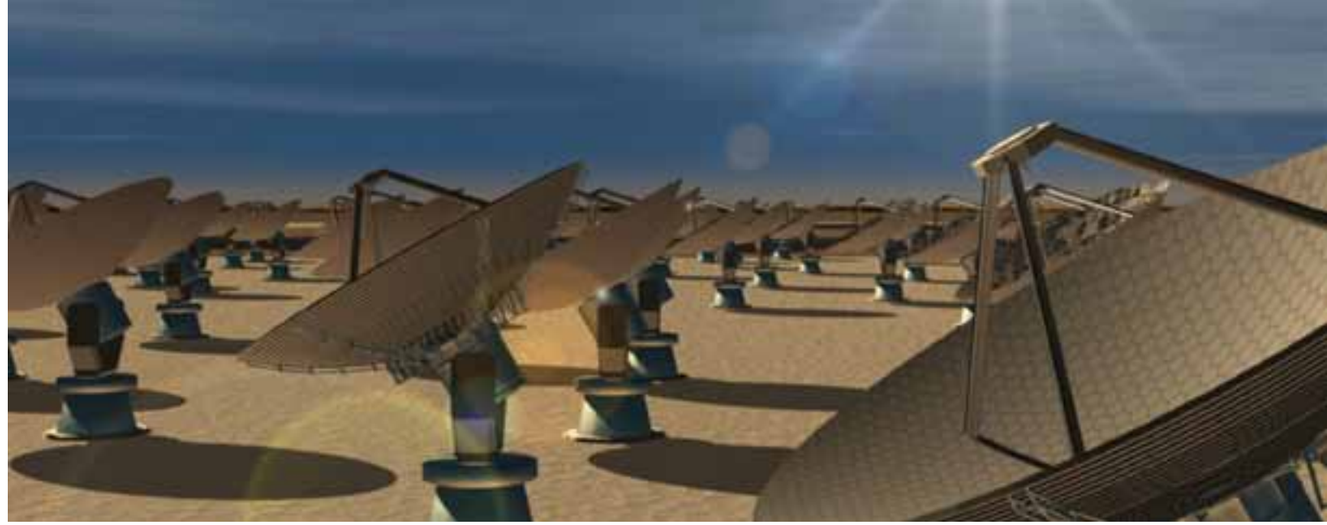
Dr Adrian Tiplady was the guest speaker at the Southern Cape Centre annual general meeting held on 14 March 2013 in George. He is presently the SKA Site Bid Manager and is one of the key persons involved that resulted in South Africa securing the hosting for the major portion of the SKA. His talk included details of the rationale behind the project, the strategic significance of the siting of the telescope, and many details of the challenges and progress to date. The SKA is one of the government's 18 Strategic Infrastructure Projects (SIP's) that are led by the Presidential Infrastructure Co-ordinating Commission.

Dr André Tiplady

The fully constructed SKA will be an array of radio antennas that, together, will exceed the sensitivity of the best available instruments today by almost two orders of magnitude. It will feature approximately 3,000 dish antennas (operating above approximately 1GHz), together with next-generation phased aperture arrays (operating below approximately 1GHz, and able to provide instantaneous all-sky coverage). The SKA will provide unparalleled performance, enabling astronomers to study the evolution of the universe, gaining new insights into the nature and origin of our universe, to test Einstein's laws of relativity, to identify the origin of magnetic fields that weave through the millions of galaxies that fill the universe, and to potentially find other habitable planets like our own.

One of the key scientific goals of the SKA is to understand the nature of 'Dark Matter' and 'Dark Energy'. Only 4% of the universe is currently understood.



The remaining unknown content is referred to as dark matter (21%), which acts to hold galaxies together, and dark energy (75%), which drives the expansion of the universe at an ever increasing rate (much like anti-gravity). This expansion results in a measurable Doppler effect on the 1421MHz radio signal emitted by the atomic hydrogen gas that fills our universe. The older the signal, the more it would have been stretched by continuous expansion of the universe (referred to in astronomy as red-shifting), and hence the lower the frequency at which it is detected – a fantastic tool to study the time evolution of the universe.

Clear reception of the extremely weak cosmic radio signals in the operating frequency range of the SKA, 100 MHz to 10 GHz, is key in answering many of the fundamental scientific questions faced by astronomers today. The minimum threshold levels of interference for radio astronomy observations is approximately 15 orders of magnitude more sensitive than a standard GSM cellular phone – around -255dBW/Hz. It is therefore important for the SKA to be located in an area with a very low level of electromagnetic radiation or radio frequency use within its operating frequency range. The Karoo region of the Northern Cape Province in South Africa, where only 2% of the population resides with commensurate economical and industrial activities, is one of the best areas for establishing and operating astronomical facilities. The evidence is in the choice of South Africa as the preferred site to host the SKA but with a dual-site implementation model.

The SKA will be deployed in 2 phases and use three types of antenna systems: sparse and dense phased aperture arrays, conventional dish antennas using wideband feeds, and dish antennas using focal plane phased array feeds (a hybrid combination between conventional dishes and phased array feeds). The first phase (SKA Phase 1) will see the establishment of 254 x 15m diameter offset Gregorian reflector dishes in South Africa, equipped with wideband feeds. 25% of these will comprise the South African design and developed MeerKAT radio telescope. Phase 2 will see this number increase to approximately 3,000 dishes – 50% within a 5km core, 80% within 180km of this core, and outlying stations in 8 other African partner countries to provide exquisite resolution. These dishes will be complemented by dense phased aperture arrays established out to 180km from the central core.

In the dual-site implementation, sparse aperture arrays (operating in the frequency range 50MHz to 350MHz) will be established in Western Australia in Phase 1, complemented by 96 x 15m diameter reflector dishes equipped with focal plane phased arrays. Phase 2 will see the expansion of the sparse aperture arrays out to 180km from the central core.

The overall cost estimation for the SKA is between 2.5 - 3 billion Euros for capital expenses and about 200-million Euros per annum for operations and maintenance for a period of 50 years, with an estimated electrical power requirement of 110 MVA – mostly driven by a supercomputer that is 100 times more powerful than the fastest supercomputer today. Exa-scale computing is required! Full scientific operations is due by 2024, although early science will be possibly from 2016 when the first parts of the facility are commissioned.

The long term protection of the geographical area in which the SKA will operate is vital for such a sensitive instrument with a high global investment and a long expected life time. Although an area with low presence of radio frequency interference was chosen, this advantage must be maintained (and a few existing high level interference sources mitigated). The South African Astronomy Geographic Advantage Act, promulgated in 2008, provides the basis for such protection in the long term, as it empowers the Minister of Science and Technology to make necessary regulations that prescribe protection criteria and standards, whilst ensuring the maintenance of essential services and making available alternative, radio-astronomy-friendly means of access to telecommunication services. wn

Preparing for winter power outages

BY | GARRETH JOHNSON | POWERMODE

Seasonal increases in the use of heaters, lighting and air conditioning systems, combined with uncertainty over the continuity of the municipal power supply this winter, are again placing the spotlight firmly on the efficiency of emergency, standby power supply systems, particularly in mission-critical applications.

This is the view of Jack Ward, MD of power provisioning specialist Powermode, who says the threat of 2008-style load-shedding and power cuts is looming large this winter.

"As a result, the need to ensure that generators and uninterruptible power supply systems are serviceable, and are not slowly degrading through neglect, is paramount," he stresses.

Ward lists common faults such as dead or unserviceable batteries – in the case of UPS systems – and clogged diesel injectors or blocked carburettors in generators will leave many organisations ill-prepared for the power outages that can be expected in the coming months.

He warns that corporate emergency standby power equipment is often neglected by staff members appointed to manage it because this is not their core function. "It does not attract attention until there is a power outage. Then it is expected to function immediately and reliability, enabling the company to be productive," he says.

He warns that UPS systems are faced with tough operating environments, including unstable power ranges, damaging voltage spikes and surges, and transient voltages that challenge their reliability.

"We find that failed UPSs and generators are usually located in less-than-ideal locations. For example, they're often found in hot, dusty closets or forgotten in storerooms, under desks and in dusky hallways. Generators are located outside in a yard, in a parking bay or receiving area and the enclosures are less than secure – resulting in fuel theft - and open to the elements."

"In many instances, in-house support personnel are unskilled, ill-equipped or unmotivated to perform the basic maintenance and testing procedures required to ensure proper, reliable operation of the emergency power equipment. Often staff members are hard-pressed to locate standby power equipment - let alone maintain it." Because neglect is so common and operating environments uncontrolled, Ward encourages users to outsource regular, planned maintenance to reputable, independent organisations.

Specialised maintenance personnel from these organisations will perform accurate inspections and major services on a regular basis; bi-annually on UPSs and at least quarterly on generator sets. They will also assist in the maintenance of a database and service record and an all-important load characteristics log.

"Incidental issues such as the installation environment, management commitment and the suitability - or otherwise – of operators could also be addressed and noted at the same time."

Ward maintains that the return on investment in a standby power solution is only as good as the service and maintenance it receives.

"It is better to budget a little less on the system and more on its maintenance in order to be rewarded with reliability and – as a result - cheaper long-term cost of ownership," he adds. wn

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By: Dick Hardie
10 June 2013

Fundamentals Of Power System Calculations
By: Prof Piet H Swart
11 - 12 June 2013

Mastering Power System Fault Calculations
By: Prof Piet H Swart
13 - 14 June 2013

CAPE TOWN

LV Protection
By: Viv Cohen
11 - 12 June 2013
Contact Dave Martin
021 7890039 / 082 8866504
Dave.Martin@saiee.org.za

JOHANNESBURG

Technical Document Writing For Engineers
By: Malcolm Haffner
18 - 19 June 2013 & 20 - 21 June 2013

Electric Arc Flash Safety
By: Zaheer Jooma
26 June 2013

Fundamentals Of Power System Fault Calculations
By: Prof Piet H Swart
17 - 18 July 2013

Photovoltaic Solar Systems
By: Attilio Dalvit
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By: Prof Piet H Swart
9 - 10 July 2013

Mastering Power System Fault Calculations
By: Prof Piet H Swart
11-12 July 2013

Should you require further information on any of these listed course and would like registration forms please contact: Roberto Benites 011 487-9042 or email roberto@saiee.org.za

THE GREEN SOLUTION TO SOUTH AFRICA'S ELECTRICITY CRUNCH

Renewables to the rescue

BY | JOHAN VAN DEN BERG **|** CEO **|** SOUTH AFRICAN WIND ENERGY ASSOCIATION

The good news is that the knight in shining armour is ready to step in and save the day.

As for the bad news, a lot of it has been going round lately. To paraphrase Charles Dickens, the prospects have grown ever stronger that the middle months of 2013 will prove to be the winter of our energy sector discontent. Industrial action at Medupi has been dragging on at an estimated cost of ZAR 30 million a day. Efforts to ensure timeous commissioning of the first unit in December 2013 were scaled up and various assurances given – but the rumours of likely delays stretching to twelve months (or longer) persist.

This amidst cost over-runs at Medupi and Kusile that have been considerable and an electricity reserve margin running at a reported 1.5% (the international norm is about 15%). NERSA recently held public hearings into Eskom's request for a 16% per annum electricity price increase in each of the next five years and ultimately granted "only" 8%, casting doubt on where the utility will find the money it needs to survive. During the hearings it appeared that the lights are being kept on by so-called "power buy-back agreements", where the national utility essentially pays large industrial users not to produce their core products to their full capacity so that the electricity can be deployed elsewhere in the economy. It is understood about 1,200 MW is being bought back in this manner – considerably more than the Unit 1 at Medupi would have supplied even if it had been up and running today.

The country has aspirations of growing the economy at 4 – 5% per annum in order to create the jobs we so desperately need to address unemployment and poverty. For this we need energy and more specifically, electricity. The reality is that we haven't had it since the rolling black-outs in 2008, and that only a depressed world economy has hidden the fact that the problems have not gone away.

There are a number of realities that we will ultimately have to face, and the day of reckoning may be only a few months away:

WE DON'T HAVE ENOUGH POWER

It is abundantly clear that a reserve margin of 1.5% is simply far too low. Maintenance has not been done to the degree that Eskom would have wanted to, for the reason that we needed the plants to run almost all the time – to keep the lights on. The open cycle gas turbines (low capital, high running cost that are supposed to be used only when demand is very high) have had to be used far more often to supplement power from more conventional, base load sources. The financial losses are likely to harm Eskom at a time when it cannot afford further set-backs. In the past days, the responsible officials have started to communicate that load-shedding this winter is imminently possible.

NO CONVENTIONAL POWER SOURCE CAN AFFORDABLY FIX THE PROBLEM IN THE SHORT TERM

The time required to move a conventional coal or nuclear power plant through the development cycle is 8 – 10 years at the very least. This means that any decision taken today, if using these technologies, can only ease our electricity supply constraint a decade from now. When Medupi Unit 1 is commissioned, it will not ease the supply constraints but will only enable some of the large users to manufacture at full capacity again (rather than accepting power buy-back agreements). The reserve margin will remain where it is or deteriorate further. The only solution other than renewable energy would be the use of "peaking plants", fuelled by diesel or gas. This could be done

Renewables to the rescue

continues from page 39

rapidly but would imply production costs in the order of ten times the Eskom average – perhaps in the ZAR 4,50/kWh range. In the process, further pressure would be put on electricity tariffs.

NOT HAVING POWER IS FAR COSTLIER THAN HAVING IT

Peaking power plants are presently more expensive per energy unit than any of the major renewable energy sources. We can thus assume that ZAR 4,50 is more or less the upper limit of what electricity can cost today. As against this, NERSA determined that the cost to the economy of the 2008 black-outs was an astonishing ZAR 75/kWh – about 85 times the cost of wind power and 17 times the cost of peaking power. This shows that while we do not have power, arguments about the costs of various technologies miss the point that any power will be far cheaper than no power.

PRIVATE INVESTEMENTS

Government has committed enormous amounts to supporting Eskom's balance sheet and can/will do no more – private investment is needed.

According to research done by Standard Bank, Government has already supported the Eskom balance sheet by about ZAR 350 billion in loan guarantees and shareholder loans/equity. To put this in context, it is 16.9% of GDP and measured this way constitutes a "bail-out" far larger than the banking bail-outs in Spain, the UK and the USA.

Only in Ireland did the government commit a larger portion of GDP to the banking bail-out. In this context it is evident that the "SA Inc" piggy bank is empty and that we need private capital to add new capacity to our electricity grid.

THE TRUE COST OF COAL POWER MAKES IT UNAFFORDABLE

For a long time we have known that certain industrial processes cause harm to people, eco-systems and economically productive systems beyond their own boundaries. These costs need not be reflected in the costs of whatever product the industrial process produces and are referred to as "externalities". Because externalities are hard to quantify, they have often been ignored. However, the University of Pretoria have now quantified the costs of producing electricity from coal at Medupi at a staggering ZAR 0,97 – ZAR 1,88/kWh[1], making coal far more expensive than both wind power (by a factor of about 2.5) and also significantly more expensive than solar PV power. This is an actual cost to the country, and the fact that it could conveniently be ignored will, alas, not make it go away. In order to optimise the country's economy, we have to take it into account and conclude that coal power is unaffordable.

CLIMATE CHANGE EFFORTS

South Africa has committed to climate change efforts that necessitate a large renewable energy sector. At the international negotiations on climate change that took place in Copenhagen ("COP15") in December 2009, South Africa committed to significantly reducing its greenhouse gas emissions. This commitment manifested in the Integrated Resource Plan of 2010, which envisions 42% of new electricity capacity to come from renewables by 2030.

NEGATIVE ASPECT OF INDUSTRIAL LOAD SHEDDING

Industrial load shedding now will lead to job losses and insolvencies. The economy has not yet recovered from the global financial crisis. Industrial load shedding will lead to financial losses, insolvencies and job losses. This is unaffordable at present.

RENEWABLE ENERGY PROJECTS

In terms of the procurement rules and developer undertakings for renewable energy plants, 3-5% of ownership will lodge with local communities. Further, 1-1.5% of turnover will be spent on socio- economic development, usually within the immediate radius of the project (usually rural areas). Moreover, 0.6% of turn-over will be spent on enterprise development – most often this will target education and skills development in the area.

These amounts become very significant over the project lifetime and are likely to make a strong contribution towards community upliftment, job creation and social development.

If we had to draw up a wish list that might emanate from the people charged with managing this very delicate South African energy situation, it might include the following ruminations: *"I wish we had lots of electricity plants ready to be built tomorrow; I wish they could provide additional power quickly; I wish they could be financed by private capital; I wish they could be affordable; I wish they could be counted on to ease our electricity supply constraints; I wish they could help us reach our climate change objectives; I wish they could create jobs, facilitate skills development and lead to socio economic benefits; I wish they could empower rural communities."*

The excellent news is that this entire wish list can be satisfied by a deployment of Renewable Energy (RE), as appears in the discussion below:

READY TO BUILD MORE RE PLANTS

Already, a total of 634 MW of wind power and 631 MW of solar PV power is under construction, while 150 MW of Solar Thermal power is also being built. To demonstrate the scale of what is happening already, South Africa has only eight operational wind turbines at present – but 250 more are under construction.

But the truly remarkable figure is not what is being built but what is ready to be built – perhaps in excess of 100 renewable energy projects that have completed resource assessment, financial feasibility studies and have received approvals from the authorities after exhaustive Environmental Impact Assessments. These projects are ready and raring to go. Their combined capacity - even after subtracting for the fact that they may compete for grid access - is between 3,000 and 5,000 MW.

ONTO THE GRID, QUICKLY

The commissioning time for a Solar PV plant can often be under a year while even a very large wind farm can be built in 18 months. Renewable energy gives us power, quickly.

PRIVATE CAPITAL

On 30 October 2012, Business Day reported on its front page that South Africa had pushed the button to go ahead with a ZAR 47 billion procurement of green energy. No portion of the capital to build these plants will come from government – indeed, government will pay only for the electricity. Of the ZAR 47 billion, about 75% will come from bank loans in project finance transactions while the remaining 25% (perhaps ZAR 11,75 billion) will come from private investors in the form of shareholder equity. In many instances, the funds came from abroad, meaning that South Africa is gaining significant Foreign Direct Investment.

AFFORDABLE

Already, wind is being procured from the developers of wind farms at rates as low as 89c/kWh (levelised cost over the lifetime of the contract). The best estimate of the cost of new coal in SA is ZAR 0,97/kWh, while nuclear power is more expensive. Wind power is thus the cheapest source of new energy at scale. When the externalities are accounted for, solar PV is also much more affordable than coal power.

DEPENDABLE

A frequent question asked about renewable energy is whether we can depend on it. We like to think we can flick a switch at a coal plant and have power, but people ask about the wind not blowing and the sun not shining. Much academic work has already been done in this regard in South Africa. Modern wind turbines are very efficient and South Africa has a large landmass which implies a wide spacial distribution between wind farms. The wind may not blow everywhere every day, but it always blows somewhere. The result is that we can model what percentage of installed wind power will always be available.

The figure is around 25% and is known as the capacity credit. Thus, if we install 1,000 MW of wind power, about 250 MW will always be available and can be banked on. In addition, South Africa already has the peaking plants that one would normally build to be on stand-by should the renewable energy plants produce less than normal. More such plants are on the way and will further facilitate the absorption of renewable energy into the grid.

CLIMATE FRIENDLY

The power produced by renewable energy plants need not be produced in conventional, coal-fired power plants. For this reason the greenhouse gas emissions that would have been produced by coal power are off-set by the production of green energy

JOB CREATION, SOCIAL UPLIFTMENT, RURAL DEVELOPMENT

Above these benefits as they will be produced by renewable energy projects were discussed. Renewable Energy is a significant new infra-structure sector with a long supply chain extending to construction firms, electrical engineers and –contractors, logistics companies, banks, lawyers, environmental practitioners, wind and solar measurement companies, specialised employment agencies and many more.

As larger percentages of the hardware is manufactured in South Africa, the job creation and skills development potential will increase further. The socio-economic development programmes imbedded in each successful renewable energy project through the procurement rules will make a significant difference to the rural communities that typically live near renewable energy developments.

In conclusion, to briefly return to Dickens and A Tale of Two Cities: We may be facing the winter of our discontent, as our reserve margin runs out and load shedding occurs. But that will be followed by the spring of our hope, as renewable energy plants approach commissioning and transform the energy sector for good. WN

PART 1: A HISTORICAL REVIEW

Uranium Technology

It is an unfortunate quirk of fate, and one that history won't let us forget, that the military use of nuclear technology preceded the civilian application by eleven years. Nuclear devices were detonated over Hiroshima and Nagasaki in August 1945. The first Nuclear Power Station, Calder Hall (initially 80 Megawatt) in Cumberland (UK) started feeding electricity into the National grid on 17 October 1956.

BY | FELIX BOSCH **|** NED **|** AM(SA) **|** MECH E (RTD) **|** SM(SA) IEE (RTD) **|** MDP (UNISA) **|** AEP (UNISA)
(FORMERLY: HEAD OF TECHNICAL INFORMATION, URANIUM ENRICHMENT CORPORATION OF SA)

In the mind of the man in the street, nuclear technology remains synonymous with weapons; it is however, like petrol. It can be used for the peaceful purpose of propelling a motor vehicle, or for the destructive application, of a petrol bomb. The possession of a nuclear capability is a strong deterrent to war, and not a threat, there have been no Nuclear attacks since the initial two! Vegetius (4th - 5th century AD) said: *"Let him who desires peace, prepare for war"*. Everyone can obtain petrol but how many are in fact petrol bombers?

It is a matter of some conjecture as to the exact date, that South Africa entered the nuclear scene; historical dates that spring to mind are 1952 when the first commercial quantities of uranium oxide (U^3O^8) were exported. Uranium exports soon became a significant source of foreign exchange. A further, very important milestone was the formulation, in 1957, of the National Nuclear Program for South Africa. The late Dr AJA Roux, who had been attached to the Atomic Energy Board, since 1955, prepared this program.

The decision for South Africa to embark on a nuclear program was based exclusively on solid scientific and economic facts. Politics played absolutely no part in this decision. In later years however, politics obviously influenced nuclear decisions. These decisions were however, always taken, with the best interest of the country in mind. The scenarios that prompted those decisions have changed significantly. Leaving the decisions open to controversy. Politicians and half-baked newspaper editors are quick, in hindsight, to attack these decisions. Usually totally out of context, in order to brainwash the ignorant masses.

It must be emphatically stated, that a nuclear reactor used for generating electricity can be fuelled with natural uranium. There are however, sound technical reasons for using slightly enriched (3 - 7%) uranium. To make a nuclear weapon from uranium, requires highly enriched (very close to 100%) material. The technology for producing weapons grade material is in many ways more complicated than that for producing reactor fuel. If natural uranium is used, a moderator such as graphite or heavy water must be used, whereas with enriched uranium ordinary demineralised water is used.

A report which appeared in 1968 indicated that nuclear generated energy would be economical in the Western Cape by around about 1980 since it was far from the inland coalfields. A further report, indicated that power generated by an enriched uranium system, could have a unit cost, as much as 20% lower. In 1976 the decision to introduce nuclear power in South Africa was taken.

Construction of Koeberg, South Africa's first and only nuclear power station, commenced in 1976. The station started generating on the 4th April 1984, and has therefore completed about three decades of successful operation, from its two, 922 MW units. These units are fuelled by slightly enriched (3%) uranium.

The decision to embark on a uranium enrichment program was also based on sound and irrefutable economic facts. At this stage, the United States, Britain and France were the only countries in the Western world able to supply enriched uranium, commercially. Important considerations that influenced the decision were:

- South Africa is one of the three major producers of uranium and has about 20% of the total reserves of the Western World. Mining costs are relatively low and in most cases it is a by-product of the gold mining industry.
- In 1979 South Africa earned R500 million from the sales of natural uranium. This figure could have been considerably higher if enriched uranium was marketed. One of South Africa's major economic problems is that we export raw materials and import manufactured goods. This was improved somewhat by the strategic requirements of the Second World War to embark on this program was therefore sound export policy according to estimates, by economists and scientists in several countries.
- There would have been an increasing demand for enriched uranium during the eighties. A shortfall was even predicted. This was unfortunately not the case. The decision was however, a sound one, given the scenario of that

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time. Remember, hindsight is an exact science.

- The oil-crisis of the early seventies suddenly let countries realise how dependent they were on oil. The oil producing countries started their own price war, holding non-oil-producing countries to ransom. Many countries started initiating nuclear programs to supplement their other energy sources. South Africa had to ensure that it always had sufficient enriched uranium for its own nuclear power station.
- Various estimates were made as to the extent of fossil fuel reserves. This prompted exploration for possible further oil and gas deposits. Nuclear energy remained a very promising alternate energy source.
- It was sound economic policy to rather use our fossil fuels (coal) to produce products for the chemical industry. Coal has more than 600 by-products; notably, petrol, tars, waxes, dyes, and naphthalene, among others. This prompted the establishment of SASOL as far back as 1953. This decision has saved South Africa billions of Rand in foreign exchange.
- The increased awareness of environmental pollution, gave impetus to increased research into other sources of energy. Hydro, solar, wind and wave options were all thoroughly researched. At that stage the nuclear option emerged a clear winner.

It is obviously of vital economic and strategic importance to be able to enrich uranium. Countries that have this technology regard the information as *'SECRET'*. The basic principles of uranium enrichment are fairly simple, although the practical application thereof poses several very complicated problems.

The leading question is then; how do we separate these isotopes and consequently enrich uranium? Only a few countries had this knowledge *(when South Africa took the decision)* namely, Russia, China, America, France and Germany. India had exploded a nuclear device presumably made from plutonium obtained from a fast-breeder reactor.

The enrichment process used at Oak Ridge USA in the *'Manhattan Project'* for obtaining the material used for the bombs dropped on Hiroshima and Nagasaki in 1945 was the gas diffusion process. The plant consisted of 2304 stages, and the process buildings occupied 16,2 hectare. Total cost of the plant, in 1945 Rand, was 236 million. This method is based on the fact that the kinetic energy of gas molecules in equilibrium is the same.

The velocities of molecules with different isotopic masses, is therefore proportional to the square roots of their masses. If a portion of the UF_6 stream diffuses through a membrane the lighter molecules will move through easier. The result of this is depletion of the lighter molecule before the porous barrier and enrichment after it. Theoretically the maximum enrichment that can be obtained through a single layer is, 1,00428. This ideal separation factor is near to unity and consequently many stages are needed to obtain the 2 - 3% enrichment required for reactor fuel. To obtain the 99% enrichment required for weapons manufacture is indeed a formidable task.

Diffusion membranes pose a particularly difficult problem. Production techniques are therefore well-kept secrets. The pore size is very important. If the pores are too large collisions occur between U^{235} and U^{238} molecules resulting in remixing. If the pores are too small condensation and blocking will occur. The pore size that is used is of the order of 0,01 micron (0,00001 mm). The membrane area must be sufficient to get the necessary flow volumes.

Despite the high pore-density of 10 million, it must remain constant even after prolonged use, and the material must be resistant to UF_6. Attaching the membranes to the metal supports is also a problem.

The use of high-speed gas centrifuges is another option that may be used instead of gas diffusion, for isotope separation. With this method, relatively few units connected in series, can give highly enriched uranium. For this reason centrifuge technology is also classified 'SECRET'. Rotating drums, 1,5 m long and 0,25m in diameter appear to be the optimum. These drums must rotate at 30 000 to 40 000 RPM to give sufficient separation.

This method makes use of the centrifugal force on the isotopes to be separated. The centrifugal force on the heavier isotopes is greater than on the lighter ones. The heavier isotopes are therefore forced against the wall of the drum, where they concentrate. The lighter isotopes stay in the centre of the drum where they concentrate. The heavy and light fractions are then removed through the respective outlets.

Several problems had to be overcome before centrifuges were viable. Suitable drum materials capable of withstanding the acceleration forces due to rotation had to be developed. Special leak-free seals and couplings had to be produced and bearings had to be designed, to rotate at the high-speeds involved.

In Germany a process known as the *'Becker Nozzle Method'* was developed. This method is based on partial centrifugal separation as a result of deflected supersonic flow. In this method the UF_6 is diluted with helium.

The South African process is of an aerodynamic nature and makes use of a separative-element that is in reality a high-performance- stationary-walled centrifuge. Hydrogen is used as carrier-gas for the uraniumhexafluoride. Credit for the design of this separative element must go to the late Dr. W.L. Grant, who was awarded the top technical and scientific awards for this brilliant work. Research has also been conducted on plasma, laser, electromagnetic and chemical processes.

The separative-element is the major problem associated with enrichment technology, it is however not the only one. The oil-free compressors, special instrumentation, advanced welding and vacuum techniques and the control of the plant are all equally perplexing problems.

The research conducted on enrichment technology in South Africa, has been of immense value to the country in other spheres as well. Many advanced welding and metallurgical processes originated during this research. The welding of stainless steel pressure vessels for cryogenic applications has resulted in the local manufacture of cryogenic evaporators, used at most hospitals for boiling-off liquid-oxygen.

The special oil-free compressors developed during the program will be very useful in the chemical and food industries. The design of the separative element is used for effectively extracting dust from air.

This brief review is ample proof that the scientists involved in developing South Africa's uranium enrichment process are of World standard, all scientific giants in their respective fields, and their contribution to this country is immense.

TERMS AND DEFINITIONS

ATOMIC BOMB

The atomic bombs dropped on Hiroshima and Nagasaki consisted of a chunk of U^{235} the size of a tennis ball, which underwent fission in less than a millionth of a second and resulted in an explosion equivalent to twenty kilotons of TNT. Two pieces of U^{235}, just below critical mass were shot together very fast.

CHAIN REACTION

If every fission in a sample of fissile material causes one or more further fissions, it results in a chain reaction.

CRITICAL MASS

Too many neutrons escape from a small piece of fissile material to sustain a chain reaction but with a mass above a certain critical size the reaction causes a violent explosion. This critical mass is about one kilogram

DEUTERIUM

One in every six thousand Hydrogen atoms is different from the others; because it has a neutron as well as a proton in its nucleus (mass number 2), and is referred to as a heavy hydrogen or deuterium isotope. The other hydrogen isotopes have only one proton in the nucleus (mass number 1).

ENRICHMENT FACTOR OF NATURAL URANIUM

In a sample of natural uranium only one out of every 140 isotopes is a U^{235}. We therefore say that the enrichment factor of natural uranium (with respect to U235 is 0.7%

ENRICHMENT PROCESS

As we increase the number of U^{235} isotopes, relative to U^{238} isotopes, in a given sample we increase the enrichment factor. When we get a sample containing only U^{235} isotopes, we refer to this as 100% enriched material.

FISSILE (FISSIONABLE) MATERIAL

Material capable of undergoing fission.

FISSION (NUCLEAR)

Is when a heavy atom such as Uranium 235 splits in half with an enormous release of energy when bombarded with a subatomic particle. One fission provides very little energy. Thirty-one million-million fissions per second are required to produce one kilowatt of heat. The neutrons released travel at about 16 000 km per second. The complete fission of one kilogram of uranium, that is a sphere about 50 mm diameter, will yield as much energy as 2,7 million kg of coal.

HEAVY WATER

If the hydrogen atoms in water (H_2O) are heavy hydrogen atoms, then the water is referred to 'Heavy Water', and is chemically identical to ordinary water except that it weighs 11% more.

ISOTOPE SEPARATION

The isotopes that are to be separated, U^{235} and U^{238} are chemically identical and, absolutely minute; ten million of them side-by-side would scarcely show on a pinhead, and this makes the separation process very difficult indeed. The isotopes, U^{235} and U^{238} are chemically identical. The only physical

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difference being about 1,2% in mass. All separation methods must therefore make use of this fact.

ISOTOPES OF NATURAL URANIUM

Natural uranium consists of three isotopes (atoms with differing atomic masses) namely, U^{234}, U^{235} and U^{238}. Only the U^{235} isotope is fissile (or fissionable). The U^{234} is negligible.

ISOTOPES

Atoms of the same element, with differing atomic masses.

MODERATOR

Material surrounding the fuel elements in a nuclear reactor, to slow down the neutrons released during fission from 16 000 km per second to about 24 km per second. This is to increase the probability of the neutrons causing further fissions. Some materials that can be used are graphite, or heavy water. This can be compared with putting a golf ball; a fast putt will move over the hole whereas a slow one has a greater probability of dropping into the hole.

URANIUM ENRICHMENT

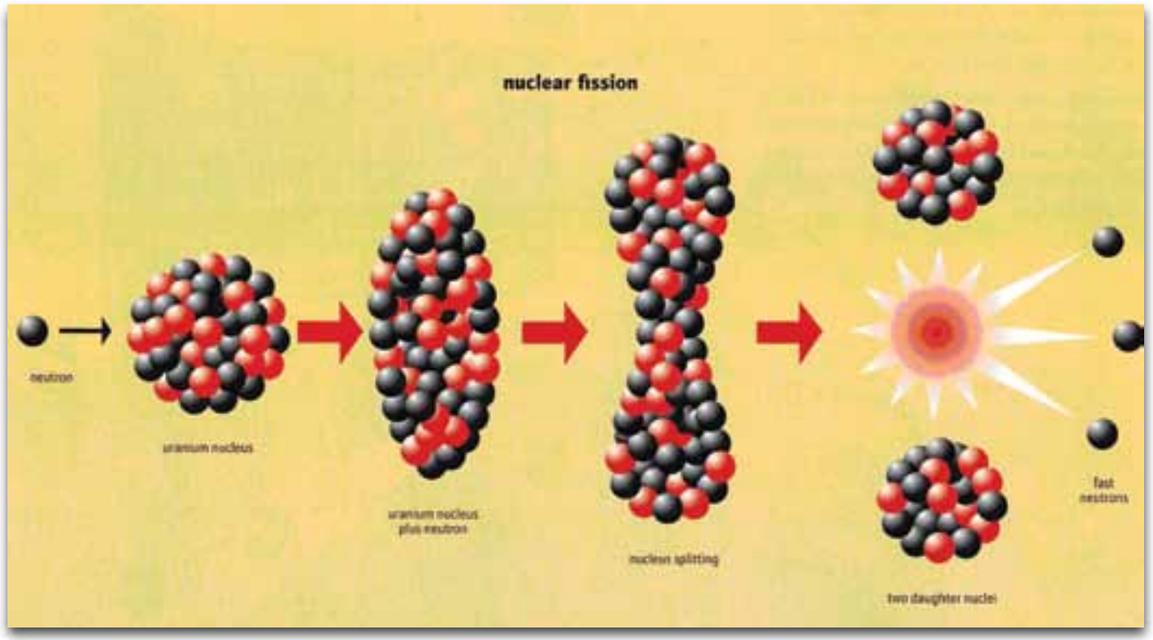
As we increase the number of U^{235} isotopes, relative to U^{238} isotopes, in a given sample we increase the enrichment factor. When we get a sample containing only U^{235} isotopes, we refer to this as 100% enriched material.

URANIUM HEXAFLUORIDE (UF_6)

The operation of an enrichment plant requires the uranium to be in a gaseous form. The only gas that is suitable is uranium hexafluoride (UF_6). Fluorine is mono-isotopic and at the operating conditions of 100 kPa and 40 - 50° C, UF_6 is a gas. It is very corrosive therefore all surfaces that are in contact must be made from special materials such as; nickel, aluminium, monel or polytetrafluoroethylene (PTFE). This makes an enrichment plant very expensive. Uranium hexafluoride is also very toxic, and the slightest inhalation causes death. This means that the whole plant, which includes all components and usually many kilometres of piping, must be 'helium vacuum-tight'. This requirement is very stringent indeed. If UF_6 escapes into the atmosphere it immediately hydrolyses with the water vapour present to form hydrofluoric acid (HF). This is probably the most aggressive substance known to man. Some separation techniques require the UF_6 to be diluted with either helium or hydrogen. Helium is expensive and hydrogen forms explosive mixtures with air, in concentrations of from 4 - 57%.

URANIUM:

Is a dark grey metal with a specific gravity of 19,6, it is therefore the heaviest of all the natural elements. wn



2013 Annual Banquet Sponsorship

It is that time of the year again, where we are planning the Annual SAIEE Banquet, which will take place at the Wanderers Club, Illovo, Johannesburg on 1 November 2013.

We went back to the drawing board to work out how we, the SAIEE, can give your more value for your money and we came up with the following:

BRONZE SPONSORSHIP - R10,000.00

The value of R10,000 will sponsor two bottles of wine per table which will sport your company name on the bottles, your company banner in the foyer and your company logo printed in the programme.

SILVER SPONSORSHIP - R15,000

The value of R15,000 will sponsor flowers which will sport your logo on a stalk - in return your company banner displayed in the foyer, your company logo printed in the programme and a free HALF page advertisement placement in the **watt**now magazine.

GOLD SPONSORSHIP - R20,000

The value of the R20,000 will sponsor the gifts for each guest, your company banner to be displayed in the foyer, your company logo and a brief synopsis to be printed in the programme, and a free FULL page advert in the **watt**now magazine.

PLATINUM SPONSORSHIP - R30,000

The value of R30,000 will sponsor the entertainment, your company banner to be displayed in the banquet hall, your advert on the back page of the programme, and 2 x full pages free advertising in the **watt**now magazine.

If you are interested in sponsoring, please contact Gerda Geyer on 011 487 3003 or email geyerg@saiee.org.za.

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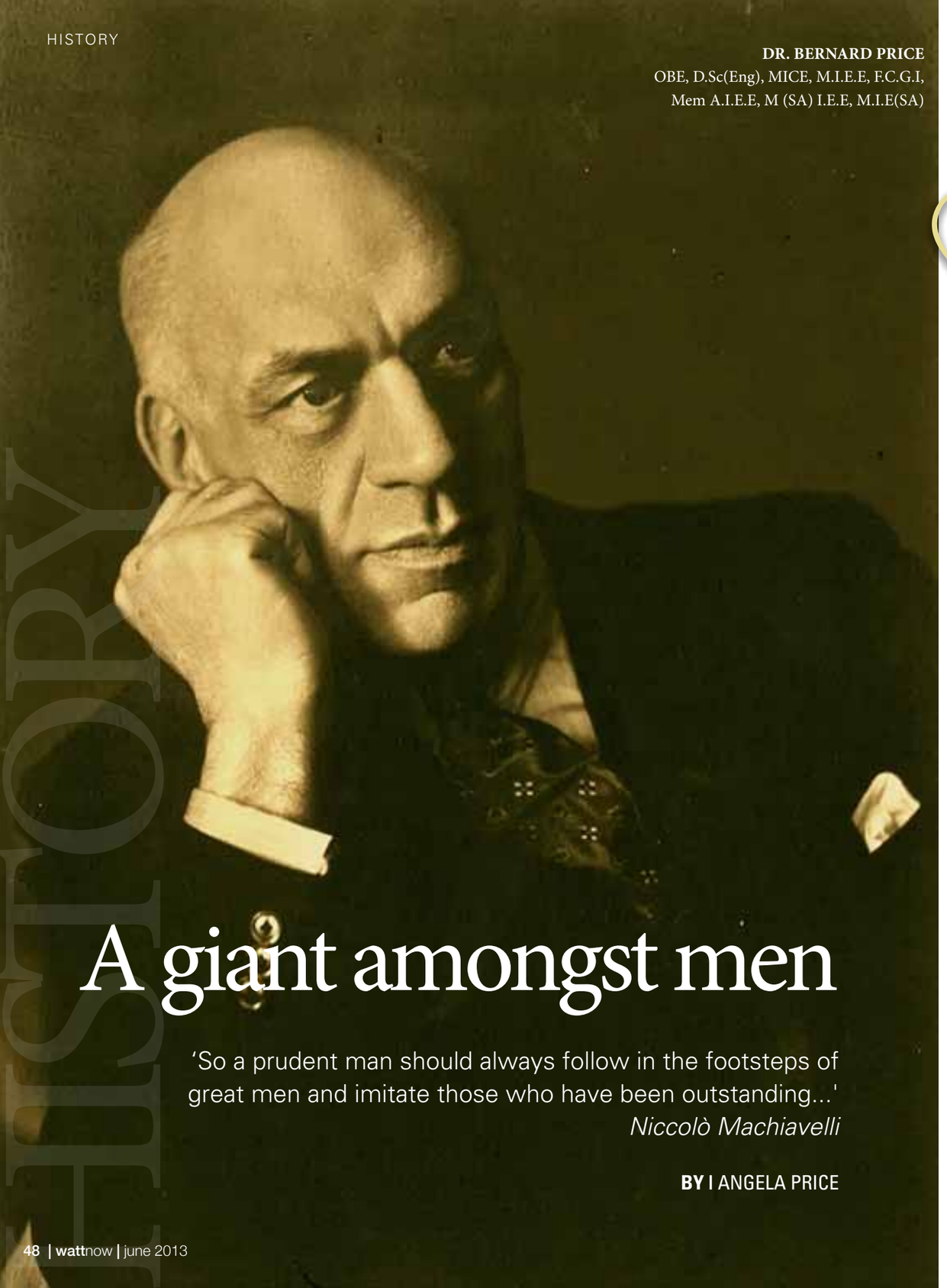

DR. BERNARD PRICE
OBE, D.Sc(Eng), MICE, M.I.E.E, F.C.G.I,
Mem A.I.E.E, M (SA) I.E.E, M.I.E(SA)

A giant amongst men

'So a prudent man should always follow in the footsteps of great men and imitate those who have been outstanding...'
Niccolò Machiavelli

BY I ANGELA PRICE

"...my wife has made me rich by insisting on darning her stockings and walking to church to save the halfpenny bus fare."

Dr. Price had a very long standing relationship with the South African Institute of Electrical engineers (SAIEE) – becoming President in 1915 and being elected an Honorary Fellow in 1940. Following his death in 1948, the institute decided to commemorate his name by hosting an annual lecture together with Wits University - to be known as the Bernard Price Memorial Lecture. This is just one of the many accolades to a great man who left behind a larger-than-life legacy.

It is not easy to follow in the footsteps of great men, and if one takes this literally, the Price descendants might be excused for finding this harder than most.

Why so, you ask? Well, Dr.Bernard Price left big shoes to fill – figuratively and literally.

Although quite a lot is known about his prowess in the engineering and business fields, less is known about his personal and family life. For example… it is not widely known that in the latter part of his life, Dr. Price had the misfortune to suffer from Acromegaly, a disease which affects roughly 1 in every 20,000 and occurs when the Pituitary Gland produces excessive amounts of growth hormone. The term 'acromegaly' literally means 'enlarged extremities' and affects specific areas of the body, such as the hands, face - and feet.

Despite his title as *'the father of electricity supply in South Africa'*, Dr. Price was not a native South African – yet he devoted the best years of his life to this country. British by birth, he immigrated to South Africa for work opportunities and adopted it as his own - contributing his valuable work expertise and knowledge at a time when the country needed it most. Undoubtedly South Africa was made a better (and brighter) place for having him choose to call it home.

Born in London in the year 1877, Dr. Price attended Saint Dunstan's College and then went on to train at the Central Technical College in Kensington where he became an associate of the City and Guilds Institute. Not surprisingly, Dr. Price exhibited great promise as an engineering student, which he built on by gaining valuable experience in several electrical engineering positions. This enabled him to join a leading British electrical engineering consulting firm, Merz and McLellan, as Chief Electrical Assistant in 1901 at the tender age of twenty three. Due to the firm's work with electric power stations and systems, he formed a particular interest in their operating difficulties. This resulted in him developing various methods of protection (from damage caused by electrical faults) for generators, transformers and cables. The best known of these is the Merz-Price differential system of protection.

Mr. and Mrs B Price

Whilst building a busy career, Dr. Price found time to court a young lady named Nora Waldegrave. A student at the London School of Music, Nora was a highly talented musician. The couple married in 1907 and had their first child (a daughter named Margaret) shortly thereafter. Nora proved to be a wonderful partner and support to Dr. Price, proving that *'behind every great man there is a great woman'*. Notoriously frugal, she ran a tight ship and loathed waste. Many years later Dr. Price told family members *"...my wife has made me rich by insisting on darning her stockings and walking to church to save the halfpenny bus fare."*

In 1909, at the age of thirty two (and with eight years of experience under his belt at Merz and McLellan) Dr. Price accepted the position of Chief Engineer and Power Supply Manager to the Victoria Falls and Transvaal Power Company (VFP) in South Africa - having joined their board a few years earlier. Due to its famed electrical storms, the Witwatersrand was the perfect location for him to continue to practise and develop his work aimed at overcoming the damage that lightning strikes caused to the high voltage lines and generating equipment – so vital to the rapidly ongoing electrification of the mines and developing power grids.

A giant amongst men

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Dr. Price's talent *(and an ever-increasing interest in research and the advances in science)* was harnessed by the South African Government, who asked him to serve as Chairman of the Advisory Committee on Science and Technology during WW1, in recognition of which the Order of the British Empire was conferred upon him in 1920.

As Chief Engineer for VFP until 1926, Dr. Price was invaluable to the growing prosperity of the Witwatersrand gold mines during the busy years of rapid mining expansion. With his guidance and contribution, the VFP was able to establish an excellent power supply system to the mines - which rapidly grew into one of the first large power grids in the world. Eighteen years after joining the company, Dr. Price became General Manager of VFP in 1927.

Until now, Dr. Price's busy career path had resulted in most of his time and energy being spent on work commitments. However, around this time he began to dedicate time towards his other passions - namely education and research. He also began a lifelong (indeed family-long) association with the University of the Witwatersrand (Wits) when the interest he took in the affairs of the university lead to him becoming a member of its council and helping *(materially)* to establish the Department of Electrical Engineering. In recognition of his contributions, Wits conferred an honorary degree *(Doctor of Science)* upon him in 1935.

His continued interest in the university as well as ongoing research taking place at the time *(particularly relating to lightening)* resulted in him funding the establishment of the Bernard Price Institute of Geophysical Research at the University of the Witwatersrand in 1937. Lead by its founding director *(and world-recognized authority on lightning detection and analysis)* Dr. Basil Schonland, the instituted developed aircraft detection apparatus *(later called radar)* for the South African Defence Force. Using their developments, Dr Schonland was able to go to the UK and make significant contributions to the war effort.

Savernake

Undoubtedly, Dr. Price was a visionary, moved by the exciting *'newness'* of a country like South Africa. He was able to see the opportunities and possibilities that this wonderfully diverse country had to offer. Whilst he obviously contributed hugely to the welfare of SA by helping it to prosper *(in the mining and engineering fields)* Dr. Price also saw the need to be a pioneer; protecting and preserving his adopted country. His interests did not stop at supplying South Africa with a reliable source of electricity – they extended into promoting education, research into the sciences and conservation of our natural heritage.

After being appointed Resident Director of VFP in 1936, Dr. Price moved into a new home on Jubilee Road *(one of the stately 'Randlord' mansions in Parktown)*. Originally known as *'Holcombe'*, the house was designed by the *(then popular)* architects, Leck and Emley in 1904 and built for Surgeon Major W.T.F. Davies. After purchasing the house, Dr. Price changed the name to *'Savernake'*, believed to be after the Savernake Forest in Wiltshire UK where he spent holidays as a young child - presumably creating many happy memories.

Alterations were made to the house in 1939 using another prominent architect, John Fassler, who was also skilled in garden design. Perhaps his influence fuelled Dr. Price's interest and delight in the garden at *'Savernake'*. Together with their dedicated gardener *(Phillip Ngcobo)*, he personally designed and laid out the beautiful garden and accompanying water features. The three-acre garden boasted natural rock cliffs, a series of waterfalls and ponds *(proof of Dr. Price's applied engineering skills)* and sweeping lawns. Held in a family trust since the death of his wife, Nora Price, this lovely old mansion has been entrusted to the safe keeping of the Witwatersrand University who currently use it as the residence for their Vice Chancellor. Today Savernake still stands proudly in Jubilee Road as a beautiful reminder of Johannesburg's history. It now also forms part of the Parktown and Westcliff Heritage Trust – identified by its Anglo Boer War Heritage Plaque.

Dr. Price and his wife Nora had four children, a daughter and three sons. The youngsters spent their early years at Savernake and received their initial education at the nearby (and still relatively new) schools of Saint Katharine's and The Ridge in Johannesburg. However, at around the age of eight all of the children were sent off to England to continue and complete their education.

Here, under the care of their guardians, they attended boarding schools for the rest of their schooling. Interaction with their parents was limited to a 3-week-long yearly visit and letter writing. Dispatching children abroad and ensconcing them in boarding schools was a very common occurrence in those days. Why Dr. Price and his wife chose to school all of their children in the UK is not quite clear, but since many of the other leading Johannesburg families were doing a similar thing, one assumes that the standard of education was believed to be higher abroad. Schooling them overseas not only secured the children a good education, but it also enabled Dr. Price to dedicate more of himself and his time to his keen interest in the sciences and work.

The four children spent their holidays with their guardians in the UK, often holidaying near the Barle River. These were obviously happy times as Dr. Price's second son *(Roger)* later went on to build his family home in *(the then new Johannesburg suburb of)* Sandhurst and name it after the river – Barle.

Despite getting on in years *(and very likely dealing with health problems)* Dr. Price's seemingly insatiable interest in the sciences and research never faltered or let up. He went on to provide further funding to the Bernard Price Institute of Geophysical Research *(which had returned to non-military related activities at the end of the war)* – expanding the institute's activities and resulting in the establishment of the Bernard Price Institute for Palaeontological Research on the same campus.

The following quote from Wits Achieve material, paints a good picture of Dr. Price's foresight *(as well as his love for South Africa, research and education)* where it recalls the inception of the Bernard Price Institute for Palaeontological Research (BPI)…

'BPI was established in 1945 following a public lecture given at the University of the Witwatersrand in Johannesburg, by a remarkable Scottish-born medical doctor-turned-palaeontologist, Dr Robert Broom. He called attention to the fact that thousands of fossils were being lost annually in South Africa because of a lack of proper facilities to collect, preserve and study them. In the audience at the lecture sat a leading local industrialist and philanthropist, Dr Bernard Price. Broom's eloquence and passion won him over and he pledged an amount of money to establish a foundation at the University dedicated to the collection, curation and research of South African fossils.'

Thus the Bernard Price Institute for Palaeontological Research (BPI) was born, becoming part of the School of Geosciences in the Faculty of Science at the University of the Witwatersrand.

Dr. Price's prominence as a leading businessman, engineer and philanthropist in South Africa *(in his time)* is evident from the historical information which exists about his work- related activities. Sadly however, fewer records seem to exist relating to his family life. Digging through family records and archives unearthed much business-related material, from typed and hand-edited speeches, to detailed minutes of meetings and perfect record-keeping of day-to-day business activities.

Fascinatingly, there is even an official company letter *(hand written)* addressed to Bernard Price detailing a meeting held with Winston Churchill predicting that war was imminent and that the company would look at moving some of its operations to various other parts of the British Empire *(presumably South Africa)*. What the search failed to bring to light were any letters to children studying abroad, personal diaries or household accounts – making it harder to gain insight into his life as a family man.

Possibly records of a more personal nature were deliberately destroyed or deemed not worth retaining once the individuals they related to had passed away. It would be a great shame if this were the case, as any

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window into the life and times of one's predecessors is always intriguing and insightful, especially to family members. In testimony to the remarkable man that he was, family records contain all 665 letters of condolence sent to Dr. Price's widow and family after his death on the 9th of July 1948.

Carefully catalogued, these paint a picture of a beloved father, inspirational business man and much admired individual – one whose loss was deeply felt by many. Dr. Price left a rich legacy to the country he chose to call home, one which was poorer now for his passing.

As his youngest son Michael *(who lived in the UK)* said in a letter to his mother after his father's death…*'I cannot help feeling all the time that it is not only a Father whom we have lost but a very great man whose wisdom, encouragement and leadership is lost to his country equally as to his family. No one could have wished for a more understanding, generous and wise father or one who set such a fine example in his life for his children to try and follow.'*

The quote at the start of this article read as follows….

'So a prudent man should always follow in the footsteps of great men and imitate those who have been outstanding.'

And it concludes…

'If his own prowess fails to compare with theirs, at least it has an air of greatness about it. He should behave like those archers who, if they are skilful, when the target seems too distant, know the capabilities of their bow and aim a good deal higher than their objective, not in order to shoot so high but so that by aiming high they can reach the target.'

Niccolò Machiavelli

Bernard Prices decedents have indeed been prudent. Although their own prowess has not equalled Dr. Price's, his descendants have all known their own capabilities and aimed high. Two of his three sons went on to become well-known engineers and leaders in industry in their own right and his third son was an accountant.

His son, Roger Bernard Price qualified as an electrical engineer and later became MD of English Electric in South Africa *(which later became General Electric Company, and later still - Altom)*. The youngest son, Michael, never came back to South Africa after qualifying as a mechanical engineer in the UK and marrying the daughter of Lord Nelson.

Dr Price's aptitude for and love of engineering and the sciences has been passed down through the generations of the Price family. In honour and remembrance, all of the first born male Prices carry his name, Bernard. Perhaps not surprisingly, five out of seven of his South African born grandsons and great-grandsons are practising engineers in South Africa, following in Dr. Price's almost larger-than-life footsteps - which you must surely agree is no mean feat. wn

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SPECIAL THANKS TO:

1. Dirk Vermeulen (Vice-Chairman of the Historical Section of the SAIEE); and
2. Members of the Price family for their efforts to retrieve historical family information.

'... If his own prowess fails to compare with theirs, at least it has an air of greatness about it. He should behave like those archers who, if they are skilful, when the target seems too distant, know the capabilities of their bow and aim a good deal higher than their objective, not in order to shoot so high but so that by aiming high they can reach the target.'

Niccolò Machiavelli

2013 SAIEE NATIONAL STUDENT COMPETITION

INVITATION TO SPONSOR

The South African Institute of Electrical Engineers are calling on companies who would like to become the sole sponsor of the annual SAIEE's National Student Project Competition. This year, the University of Pretoria will host the prestigious 2013 SAIEE National Student Project Competition.

Every year, final year students of electrical, electronic and computer engineering at South African academic universities and universities of technology are required to complete an intensive design project.

The best student project nominated by these educational institutes competes against ±15 or other presentations in the SAIEE National Student Project Competition, and prizes are awarded to the adjudicated winners. The sponsored amount of R50 000 is required and this will be used for the prizes.

The event will be published in the SAIEE's wattnow magazine. The new look wattnow magazine, launched in November 2011 has shifted the magazine up into top gear. It now receives the attention of South Africa's boardrooms and engineering offices.

It has a vibrant new look as well as fresh, high value content, written by some of the country's foremost role players and subject matter experts, as well as a mix of excellent writers from the global electrical engineering community.

If you want to attract/hold the attention of electrical engineer decision makers, and the major industry stakeholders, then wattnow is the way to go. It reaches over 17,000 readers amongst the electrical engineering fraternity, as well as SAIEE members, 42% of which are younger than 40 years of age.

The selected company who will sponsor this event will be offered two full pages of advertising, to the value of R12 900 per placement - totally free of charge*.

The Sponsor will also be able to market their brand and products at the one day presentation, subject to the approval of the host University.

Please note that a "first come, first served-basis" will be adhered to. The SAIEE reserves the right to award the sponsorship. The sponsor's name will be engraved on the two trophies, handed to the winners in each category (University/University of Technology).

If you or your company are interested to be part of this great event, please contact Gerda Geyer at the SAIEE on 011 487 3003 or email geyerg@saiee.org.za by 30 June 2013.

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SAIEE

Are our talented Engineers being disempowered and as a consequence being lost?

The rules set to address the inequalities of the past have not had desired effect in many areas of our lives in South Africa.

BY | STAN BRIDGENS | PR ENG

The poor have apparently not seen the benefit in service delivery evident by the many strikes and demonstrations, the entrepreneur and small business do not enjoy the growth expected or predicted while spending an inordinate amount of time on employer compliance of statutory dictates. The middle class suffer from a myriad of taxes and inclined tariffs for their requirements and complain about huge virtual taxes. The only beneficiaries appear to be the well connected and those that manage to exploit the artificial system of redress.

But having said that – this article is about our engineers in the work place - are they being obliquely disempowered by all the attempts to right previous wrongs?

In training engineers there are structures that prevent proper mentoring and guidance because their superiors and decision makers are not necessarily engineers but managers. This does not facilitate proper training in the workplace and could be adding to the trend that young engineers job hop chasing the money and do not acquire accountable experience – essential for becoming a competent engineer who adds value and earns a deserved appropriate salary. So we end up with an inferior product of the system. This article does not attempt to talk about the feeder education system that fails to produce engineering potential – another long story for another day.

In the workplace experienced engineer strategic decisions are thwarted by structures focussing on compliance with supplier staff and management composition as well as too much emphasis on the financial bottom line and not enough on life cycle costs and prudent asset management considerations.

This results in the end product requiring huge maintenance at the outset – unfortunately a skilled resource that SA has lost a long time ago – about when apprenticeships went out of fashion. The culture of 'buy new, don't look after, buy new again' is absolutely unacceptable apart from being unaffordable! The waste of money with this type of thinking can be better used elsewhere and the incidence of disasters avoided.

In the procurement processes - engineers are compelled to shoulder the responsibility of engineering projects by specifying accurately the requirements, compliance and outcomes required but are excluded from, or at best, their recommendations disregarded in the financial and supplier competence requirements. Track record of engineering suppliers is another criteria that does not seem to carry much weight in the procurement processes. The resulting evidence of waste and mismanagement is apparent but unfortunately not considered pertinent.

The most important disempowerment aspect driving engineers away from doing what they have been trained for, is the engineering management of projects. They have been excluded from the procurement process, had their recommendations about life cycle/asset management considerations or costs disregarded, not had much input in the choice of supplier and the penalties for poor quality or level of skills to be maintained and lastly had no input in lengthy processes to penalise or address any default or non compliance by the supplier. The reason why engineers seek employment elsewhere is because if they don't, they will be handed back the procured supplier of the project and be held accountable to complete the project within time, to the proper level of quality and within budget! Who in their right mind is going to take on this responsibility with most of the contractual elements and format of project structures from which - he as the engineer has been excluded??

The fact is that engineers have been trained to think out of the box and to be innovative – so it is relatively easy for them to find other means of earning a living. The reality is that persons trained as engineers are occupying much less onerous positions in our economy such as the financial, banking, computer application and robotics arena much to the detriment of the proposed huge South Africa's infrastructure development plans. Politicians deciding on completion dates on projects to score political points for whatever reason and doing so without consulting engineering heads – politicians being in the engineering kitchen in effect - this practice does not deserve comment except to say they get what they deserve – and who suffers?

There are existing structures in place in the engineering arena that can be adapted to raise the priority of engineering. By implementing rules and regulations that facilitate expeditious execution of procurements and addressing supplier profiles whilst ensuring the correct skills and properly trained professionals are contracted do engineering. Presently a huge resource is being lost due to the unattractive engineering scene demanding untenable conditions.

Unless something is done about empowering our engineers and implementing realistic and workable rules and regulations in the recruitment, training, procurement, project management areas in the engineering sector, the drain of competent engineers will continue. The community in all its sections outlined above will continue to suffer as the economy struggles to support the ineffective strategy.

The call in this article is for our decision makers to listen to the plea and empower competent engineers who will add value to the economy, if even playing fields are applied, and ideology plays a lesser role giving way to prudence. wn

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RUGGEDCOM
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The RuggedCom range of products includes Ethernet routers, switches and serial devices servers. With no moving parts, a high operating temperature range and immunity to EMI these products are idea for running communications networks in harsh environments.

DAP technologies

DAP products include a full line of rugged and reliable computers from mobile PDAs to fixed-mount solutions.

- **Large display** – 10.1-inch multi-touch display.
- **Ultra-rugged** – IP65 and certified for a 6-foot drop.
- **Multiple communications options** – WLAN, Bluetooth, GPS, and optional Gobi 3000 WWAN.
- **Multiple I/O ports** – including USB 2.0, Ethernet, Serial, and HDMI.

inhand

The InHand Networks InRouter Series are rugged industrial cellular routers which are designed to transmit serial/Ethernet data remotely from multiple devices.

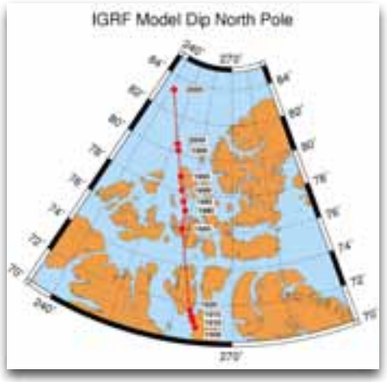
- Designed for use in harsh environments
- Operating temperature of between -25°C and +70°C,
- Immunity to EMI
- These units support VPN technologies, including IPSec/ PPTP/L2TP/GRE and SSL VPNs.

HUBBELL GAI-TRONICS
A division of Hubbell Limited

GAI-Tronics provides intercoms and phones suited for harsh environments. Phones can be ordered as either the standard Analogue or VoIP (Voice over IP) options, or as a SMART (Self Monitoring and Reporting Technology) phone.

JUNE gone so soon...

COMPILED BY | JANE BUISSON-STREET
PR ENG | SSAIEE



1 June

1831 The magnetic North Pole is found by Sir James Clark Ross while on an Artic expedition with Admiral Parry.

1935 In the interests of road safety, the British government is introducing a test for would-be motorists. The test will put drivers through their paces, checking how well they can manoeuvre a vehicle, how good their eyesight is, and how well they know the rules of the road.

2 June

1780 The Derby is run for the first time today at Epsom Downs in the South of England. Named after Edward Stanley the 12th Earl of Derby, the race is 2,4km long and entries are limited to 3-year old colts and fillies.

1896 Guglielmo Marconi, the Italian physicist, currently living in London today took out the first patent out on a wireless telegraphy apparatus. The device can transmit spoken messages without the aid of cables or wires. Presently the range of the device is just under 19km.

4 June

1798 Today Giovanni Giacomo Casanova, Chevalier de Seingalt died in Bohemia. Considered to be one of history's most flamboyant characters. He was expelled from the seminary of St Cyprian for "scandalous conduct" which then saw the start of varied and infamous career (as a writer, traveller, adventurer, soldier, spy, diplomat and lover).

1805 Trooping the Colours was held for the first time in Horses Guards Parade, London, England.

6 June

1988 In New York City David Sterm became the world's biggest bubble blower. His bubble measured 15,24m at its longest.

1961 *"Show me a sane man and I will cure him for you"*. Carl Gustav Jung, Austrian psychoanalyst died today.

9 June

1781 George Stephenson, the English engineer who developed greatly improved steam engines was born.

1934 Donald Duck makes his debut in The Wise Little Hen, providing Mickey Mouse some competition. *"Audiences will have to keep a keen ear open if they want to understand just what he is saying."*

10 June

1839 The Oxford Cambridge Boat Race (The Boat Race) took to the water for the first time along the river Thames at Henley in southeast England.

11 June

1988 80,000 people attended Mandela's 70th birthday at Wembley Arena. The only person missing from the line-up was Mandela himself.

14 June

1946 John Logie Baird, British electrical engineer who invented an early form of television, radar and fibre optics, died.

1989 Queen Elizabeth knighted former governor of California and US president, Ronald Reagan. He was one of the architects of the new cordiality between the West and East.

15 June

1752 "In a brave - or perhaps foolhardy - act, American founding father, diplomat and scientist Benjamin Franklin today flew a kite in a thunderstorm to prove his theory that electricity and lightning are the same phenomenon. He also believes that electricity is *"an Element diffused among, and attracted by, other matter, particularly Water and Metals." If it is, it should be possible to harness its power."* Franklin has several inventions to his name (such as bifocals, flexible urinary catheter and the lightning rod) which he never patented; *"... as we enjoy great advantages from the inventions of others, we should be glad of an opportunity to serve others by any invention of ours; and this we should do freely and generously."*

1860 Today, the world's first school for nurses at St. Thomas's Hospital in London was opened by Florence Nightingale.

18 June

1928 Amelia Earhart became the first woman to fly across the Atlantic when she was a passenger in Friendship, a tri-motor. Flying is a hobby Miss Earhart is passionate about and hopes to do a solo flight herself along the same route.

19 June

1829 The London Metropolitan Police was founded by Sir Robert Peel, the British Home Secretary today.

1963 In Britain, the contraceptive pill is made available to women free under the National Health Service.

20 June

1990 The Routemaster, London's iconic double-decker bus, is to be phased out after 30 years of loyal and faithful service.

21 June

1970 Soccer World Cup time; the Jules Rimet Trophy was awarded to Brazil for the third time. As winners for the third time this trophy will remain in Brazil permanently.

23 June

1912 Birthday of Alan Mathison Turing, British mathematician and computer expert who invented The Turing Machine that greatly advanced computer science.

24 June

1983 Sally Ride blasts off in the space shuttle Challenger becoming the first American woman in space.

27 June

1954 The world's first power station is opened in the Soviet Union at Obninsk.

29 June

1801 The world's first census is carried out in Britain.

30 June

1997 Harry Potter and the Philosopher's Stone by J.K. Rowling is published today. wn

Briefly to Infinity

How is it that at many major athletic events we hear of new records being established year after year? How much longer can we set new times for the 100 metres sprint or for new weights for the heavy lifts when, after all, there are limitations to human strength and endurance?

BY I BILL BRADING I CENG UK I FSAIEE I FIET

Well, actually, this can theoretically go on forever. Practical limitations will only occur when our technology fails to measure the smaller and smaller incremental advances that take place. We have only to look at the well-known geometric series to realise that every added term increases the running sum whilst the sum approaches 2 but will never make it. The mathematics of this tells us that the sum to infinity is 2, which is another way of saying it will never happen.

$$1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+....$$

Infinite series have always held a fascination for me. Some have simple sums whilst others can become hugely complex involving logarithms and particularly for no apparent reason especially as many have nothing to do with circles. Of particular interest in number theory is this one related to the Riemann Zeta function:

$$\zeta(2)=\sum_{1}^{\infty}\frac{1}{n^2}=1+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+.....=\frac{\pi^2}{6} \qquad (1)$$

Other even values of the argument yield sums having to the same even power in the denominator. Although having no obvious relationship with circles some of the methods of proof do spread some light, for example by expansion in series of trigonometric functions.

From (1) above it is a few short steps to the remarkable infinite product:

(Hint: multiply repeatedly by $\frac{1}{p^2}$ and use the prime number sieve.)

$$\frac{2^2}{(2^2-1)}\times\frac{3^2}{(3^2-1)}\times\frac{5^2}{(5^2-1)}\times\frac{7^2}{(7^2-1)}\times\frac{11^2}{(11^2-1)}\times.....=\frac{\pi^2}{6}$$

through all of the prime numbers (p) from 2 to infinity. Or you can do the same with fourth powers to $\frac{\pi^4}{90}$ arrive at or sixth powers to get $\frac{\pi^6}{945}$ and so on.

Appearances are deceptive regarding the outcomes of sequences that may seem to have similar complexities, for example:

$$\frac{1}{1.2.3}+\frac{1}{2.3.4}+\frac{1}{3.4.5}+.....=\frac{1}{4} \quad \text{whilst}$$

$$\frac{1}{1.2.3}+\frac{1}{4.5.6}+\frac{1}{7.8.9}+.....=\frac{\pi\sqrt{3}}{12}-\frac{\ln 3}{4}$$

So I thought I would try something a bit more difficult to see how complicated it can get. Here goes; find the sum to infinity of the sequence:

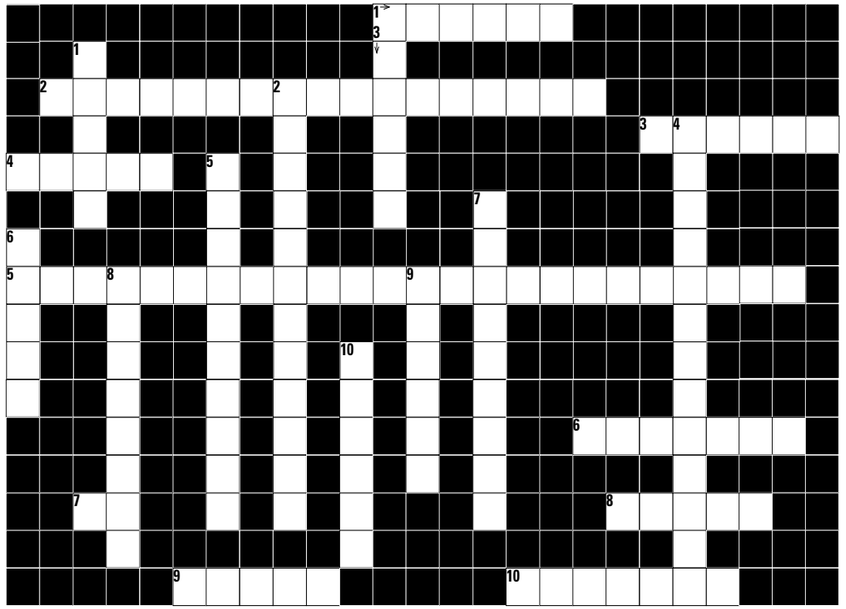
$$\frac{1}{1.3.5}+\frac{1}{6.8.10}+\frac{1}{11.13.15}+.....$$

In the July issue of **watt**now magazine, I'll show you how it's done; or you could have a go yourself. In the meantime you might try looking up the Norwegian mathematician Niels Henrik Abel (1802-1829). Good luck. Wn

Have some fun and stand a chance to win R1000.
Complete the June issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, May 2013 Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **30 June 2013**. The winner of R1000 will be announced in the August 2013 issue of the **watt**now magazine.

R1000 win

BERGMAN FISHER ASSOCIATES, DESIGNERS OF A SAFER GREENER ENERGY EFFICIENT FUTURE, ARE THE PROUD SPONSOR OF OUR CROSSWORD PUZZLE.



April issue winner:
Mahesh Govender I Durban

April issue answers:

ACROSS
1 Electromagnetism **2** Transmission
3 Siemens & Halske **4** Callan **5** Henry
6 Galvanometer **7** HVDC
8 Electric Lamp
9 Sulfurhexadluoride

DOWN
1 Transformer **2** Michael
3 Generation **4** Nicholas
5 EMF **6** Switchgear **7** Simmer
8 Jack **9** SCADA

ACROSS

1. The word 'telegraph' was first coined by which French inventor? (6,6)
2. Who co-developed the first commercial electrical telegraph? (7,5)
3. By which code did Telex machines sent data? (6)
4. What code is known as a method of transmitting text? (5)
5. What did Pavel Schilling design in 1832? (15, 9)
6. Which country still offers telegram services because they are thought to be more formal than an email or fax, but less so than a letter? (7)
7. Continuous Wave (abbr.)
8. What form of communication displaced telegraphy? (5)
9. Independant Communications Authority (abbr.)
10. During the 1930s, which country was the first to implement a wide-coverage Telex network? (7)

DOWN

1. The definition of 'Communication'. (5)
2. See 2 across (7, 10)
3. See 1 across.
4. Who was the first to sent and receive radio signal, using Morse Code, in France in 1895? (6,7)
5. The first use of telecommunication in RSA was a single line telegraph connecting which two towns?(10)
6. Telegraph Exchange (abbr.)
7. What machine did the Scottish inventor Alexander Bain invented in 1843? (9)
8. See 5 down (4,4)
9. South African Commun. parastatal. (5)
10. Which city in South Africa were the first to be linked to Europe via undersea cable? (6)

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. **watt**now magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the **watt**now magazine. 7. Closing date for entry is 30 June 2013. 8. The winner will be announced in the August 2013 issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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SAIEE Membership Benefits

Members of the SAIEE now enjoy the following a wide array of benefits:

You simply cannot afford not to be a member!

- A discount of up to R1110 on their ECSA registration fee, which is due in April every year, provided that they join the SAIEE before the end of March that same year.
- Upon joining the SAIEE there is a standard entrance fee of R700, an annual membership fee of R923 for Members, and between R1129 and R1223 for Senior members depending on age. Most of this will be recovered through the ECSA discount.
- SAIEE members receive 11 issues of the wattnow magazine valued at R330.
- The SAIEE Africa Research Journal (ARJ) our peer reviewed research publication (which incorporates the SAIEE Transactions) is also available to SAIEE member's quarterly upon request.
- The real rewards of being a member can be realized through attending monthly lectures, debates, tours and site visits organized by the SAIEE. These are mostly free of charge and provide refreshments at no extra cost. Members are awarded valuable CPD credits for attending these events.
- Membership has significant career benefits, as membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for members to interact with normally inaccessible captains of industry.
- SAIEE letters after your name indicate your membership grade and are a useful measure of your experience.
- Members receive generous discounts on the SAIEE run CPD courses and earn (category 1) CPD credits. Members also have the option of joining the wattnow online CPD program at a fraction of the cost.
- The SAIEE mentorship program assists members to gain professional status through the Institutes large database of mentors.
- SAIEE members are awarded 1 CPD credit (Category3) for being a member of the SAIEE.
- Members are able to serve on organizing committees and gain valuable experience and professional networking in doing so.
- Use the electrical engineering library at SAIEE House.

APPLICATION REQUIREMENTS FOR SAIEE MEMBERSHIP

It is always exciting to receive an application as it means that we will soon be welcoming another new and valuable SAIEE member to our family of nearly 6000 members. However, more often than not the application is incomplete. To avoid unnecessary delays in the process it is important to highlight the problems regularly experienced within the administration with received applications:-

Many applicants do not read the list of requirements.

WE REQUIRE THE FOLLOWING DOCUMENTS:

- Copy of the applicants ID;
- Certified copies of achievement certificates;
- A copy of the applicants latest CV;
- The completed application form;
- Proof of payment for the application and membership fee which are required upfront. ***Please use surname and initials as payment reference.***

Copies of the required documentation should accompany the application forms but unfortunately we still find application forms are sent in without it.

A number of applicants do not complete the application forms adequately, ***please complete the form in full.***

Payment of both application fees and membership fees are frequently not paid timeously.

Only once all the above requirements have been met is the application considered complete, enabling the process to continue efficiently.

Please, help us to help you receive the many benefits of SAIEE Membership sooner rather than later!!

2013 Membership fees

Rates as from 1st January 2013

Grade of Membership	Annual Subscriptions paid by 28 February 2013		Annual Subscriptions paid after 28 February 2013		New Members FEES * see Notes 1 & 4 below.	
	RSA incl VAT (R)	Outside RSA excl VAT (R)	RSA incl VAT (R)	Outside RSA excl VAT (R)	RSA incl VAT (R)	Outside RSA excl VAT (R)
Student	**117**	82	130	92	130	92
After 6 yrs study	**752**	526	835	593	835	593
Associate	**752**	526	835	593	835	593
Member	**831**	582	923	648	923	648
after 6 years	**972**	680	1,079	765	n/a	n/a
after 10 years	**1,016**	711	1,129	801	n/a	n/a
Senior Member	**1,016**	711	1,129	801	1,129	801
after 6yrs/age 40	**1,102**	771	1,223	868	1,223	868
Fellow	**1,102**	771	1,223	868	1,223	868
Retired Member (By-law B3.7.1)	**465**	326	515	365	n/a	n/a
Retired Member (By-law B3.7.3)	**nil**	nil	nil	nil	n/a	n/a

NOTE

1. Entrance fee for all grades of membership is R700 (except Students which is free)
2. Transfer fee to a higher grade is R400.00 for all grades of membership (except Student within 3 months of qualifying).
3. Members are encouraged to transfer to a higher grade when they qualify. It will be noted that the fees of Member and Senior Member grades after 10 and 6 years respectively are equal to the fees at the next higher grade.
4. Members elected after June 2013 pay a reduced subscription fee.

By-law B3.7.1 reads "a member in good standing who has been a member of the Institute for at least ten (10) consecutive years, has reached the age of sixty (60) and who is no longer actively engaged in the profession, may apply to Council for an adjustment in the amount of his subscription.

By-law B3.7.3 reads "any member complying with the conditions of B3.7.1 but who has been a member of the Institute for not less than 25 consecutive years, shall be exempt from the payment of further subscriptions." Members who comply with the requirements of By-Law B3.7.3 may make written application to Council for exemption form paying subscriptions.

By-law B3.9 reads "any member in good standing who has been a member for fifty (50) consecutive years shall be exempt from the payment of further subscriptions."

Members not in good standing by failing to pay their subscriptions by end of June of each year will be struck-off the SAIEE membership role - subject to Council decree.

Members in good standing and no longer in substantive employment and do not receive payment or salary for work done may apply to Council for a reduction in their annual subscriptions.

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www.saiee.org.za

Calendar of events

If you want to see your function or event listed here, please send the details to Minx Avrabos at minx@saiee.org.za

JUNE 2013

3-6	ECCE Asia 2013	Melbourne , Australia	www.ecceasia2013.org
12	SAIEE Presidential Address	Pietermaritzburg, KZN	geyerg@saiee.org.za
13	SAIEE Presidential Address	Durban, KZN	geyerg@saiee.org.za
16-19	2013 IEEE Transportation Electrification Conference and Expo	Metro Detroit MI , USA	www.itec-conf.com
20	President's Invitation Lecture	Univ of Johannesburg	geyerg@saiee.org.za
23-26	2013 IEEE 14th Workshop on COMPEL	Salt Lake City UT , USA	www.ece.utah.edu/compel13
24-27	Road Trans Africa 2013	Sandton Convention Centre	www.terrapinn.com

JULY 2013

23-26	KZN Industrial Technology Exhibition 2013	Durban Exhibition Centre, Durban	www.kznindustrial.co.za
16-19	2013 IEEE Transportation Electrification Conference and Expo	Metro Detroit MI , USA	www.itec-conf.com
23-26	2013 IEEE 14th Workshop on COMPEL	Salt Lake City UT , USA	www.ece.utah.edu/compel13
26	SAIEE Wattnow Breakfast	SAIEE House, Jhb	geyerg@saiee.org.za
29 - 1	ASME 2013 Power Conference	Boston, Massachusetts, USA	www.asmeconferences.org

AUGUST 2013

13-15	World Trends in Maintenance Engineering	CSIR Conference Centre, Pretoria	www.m-tech.co.za/
27-30	9th IEEE International Symposium on Diagnostics for Electric Machines, Power Electronics and Drives - (SDEMPED 2013)		
		VALENCIA , Spain	www.ta.ieee.org
29	Bernard Price Memorial Lecture	Johannesburg	geyerg@saiee.org.za
30	Bernard Price Memorial Lecture	Cape Town	geyerg@saiee.org.za

13-15 AUGUST 2013
CSIR I SOUTH AFRICA
For more info visit
www.m-tech.co.za

MAINTENANCE ENGINEERS

International speakers include prof Basim Al-Najjar of the University of Växjo in Sweden, dr Ali Zuashkiani of the Center for Maintenance Optimization and Reliability Engineering of Canada, and prof Wolfgang Breymann of the Zurich University of Applied Sciences. Local speakers include prof Stephan Heyns of the University of Pretoria, Johan Jansen van Rensburg, Factory Manager of Illovo Sugar's Sezela mill, and Karlwim Heese, Business Improvement Manager at Saldanha Steel.

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17	Reliable Transformers	011 421 2333	www.reltrans.co.za
25	Becker Mining Systems	011 617 6300	www.za.becker-mining.com
31	Impact Energy	031 201 7191	www.impactenergy.co.za
55	H3I Squared	011 454 6025	www.h3isquared.com
59	Bergman Fisher Associates	011 679 3481	www.bergmanfisher.co.za
68	Powertech | TIS	012 426 7200	www.ptsi.co.za

THE FEED A CHILD GOAL

It is the mission of Feed-a-Child to provide a nourishing meal to children regardless of their cultural or ethical group – who through circumstances beyond their control, have been or are below the poverty line.

The-Feed-a-Child team works closely with people who want to eradicate poverty and make a difference by striving to bring some hope to these children in need as well as building a vision to give them a brighter future.

Realizing the importance of nutrition to a child in the early ages, Feed a Child therefore focuses on the children to help them develop to their fullest potential through our feeding scheme.

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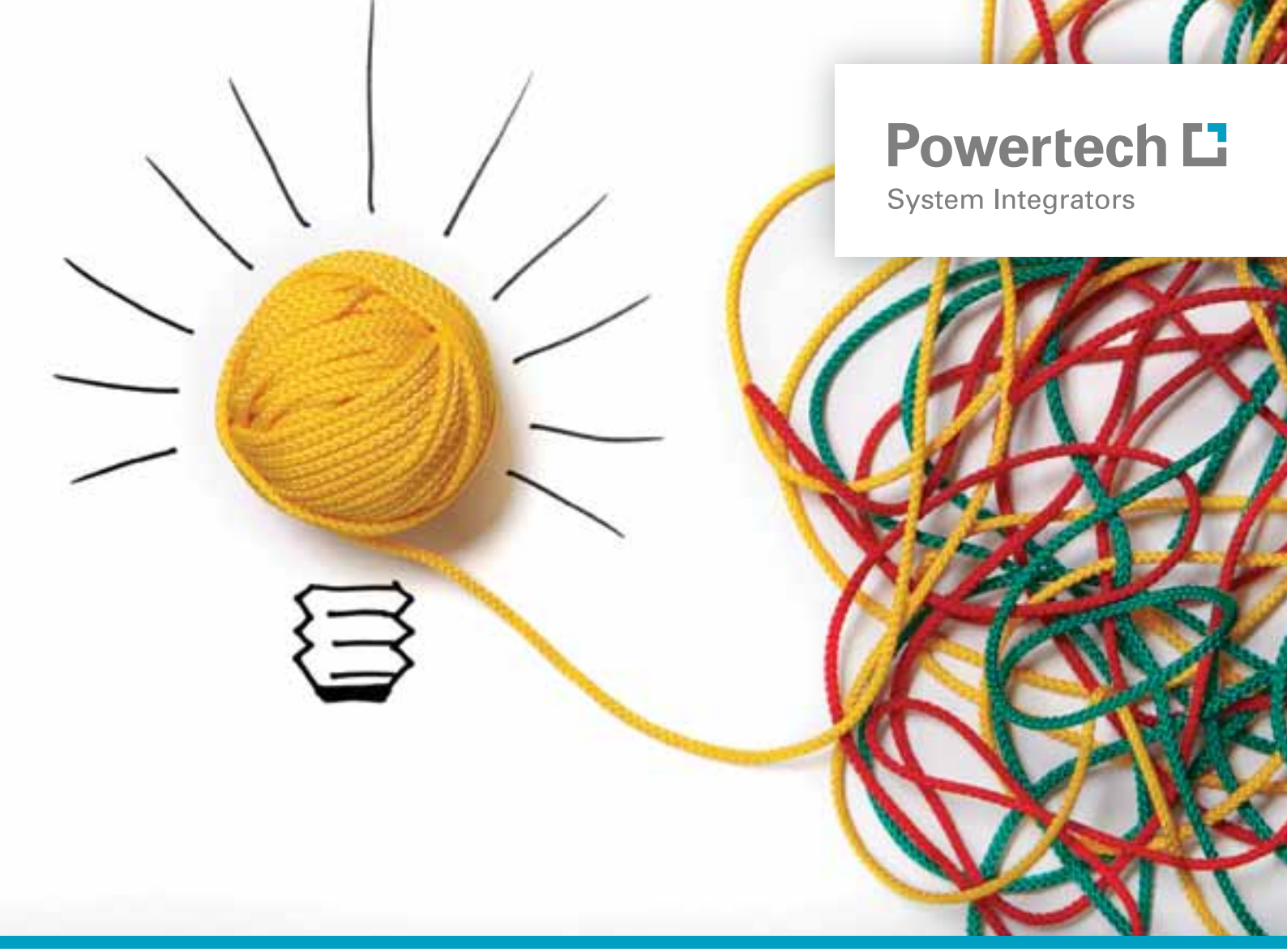

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