wattnow

SAIEE SUPPORTS ENERGY EFFICIENCY AND THE ENVIRONMENT

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the Nuclear Power issue

SAIEE THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | **JANUARY 2013**

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wattnow magazine

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With happy memories of awesome successes, we said goodbye to 2012, and now, refreshed, invigorated and inspired by the time we spent with our loved ones, we, with bated breath and huge anticipation get ready to face the reality of a new year and all of its diverse challenges and rewards.

With the dawning of the new year comes our first edition of the **watt**now magazine for 2013, and just to wet the appetite we give you a taste of how 2012 ended as we celebrated the magazines 'first' birthday with a hugely successful and extremely entertaining networking breakfast. Angela Price, the wife of Bernard Price's great-grandson, shared her personal experiences of growing up, and being married to an engineer. Many of the delegates enjoyed this tongue-in-cheek look at her life, and many could relate to it. It was really enjoyed by all. Read about her experience on page 46.

On the flip side of the coin - now that we understand the ins and outs of living and growing up with an engineer, we take some time to explore the views of Bill Bergman, who in a two part biography anecdotally reminisce over his career as an electrical engineer - pg 52.

Also included in this issue is our monthly feature on page 20, where we delve into a brief history as well as a look into the future of nuclear power in South Africa. A read that I am sure will spur some interesting debate.

On page 30 Dr David Jacobson shares his view on Intelligent Automation and explains the advances in software and hardware that enable systems and devices to control their actions autonomously and intelligently.

The season of giving may be over but the need for generosity is a never-ending drama, read on page 5 how 36 exceptional students studying electrical engineering require the intervention of some generous benefactors.

Well, herewith another issue jam-packed with content - here's wishing you a fabulous and a very profitable 2013.

Enjoy the read.

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

ELECTRICAL ENGINEERING BURSARIES

The demand is so high that there are 36 applications on hand, which are considered good prospects but sadly cannot be catered for due to financial constraints. This type of funding is usually a four year commitment and SAIEE must ensure sustainability.

The SAIEE is embarking on a new initiative in an attempt to fund these unsuccessful applications by inviting companies to contribute in a meaningful way in addressing the skills shortage in South Africa.

SAIEE will, for a nominal fee, engage with entities wishing to contribute to this scheme and administer an extended bursary programme. Appropriate terms and conditions will be negotiated/agreed upon with each participating company - depending on the company profile, this scheme could assist with capacitation of skilled staff, improved BBEEE ratings as well as tax benefits.

Most of the applications are for excelling students who have completed their first year studies, but due to the harsh economic climate they cannot continue due to the lack of funds, thus they and South Africa are being robbed of an engineering career. Tertiary education is not cheap – four year courses cost up to R45,000 p/a for tuition alone and this does not include books and residence fees.

SAIEE, through this scheme, is attempting to assist these 36 students who have successfully completed at least one or more years of their course. A fairly rigorous assessment process which mainly targets disadvantaged students as well as those shown to be high achievers in all areas in South Africa, has been completed. These low risk recipient bursars need our financial assistance and the SAIEE cannot do it alone.

The SAIEE Bursary Fund Committee has a good track record. For many years SAIEE bursars, most of whom are a product of previously disadvantaged background, successfully completed their academic training. SAIEE offers companies this expertise and selection process in administering the scheme for a nominal fee.

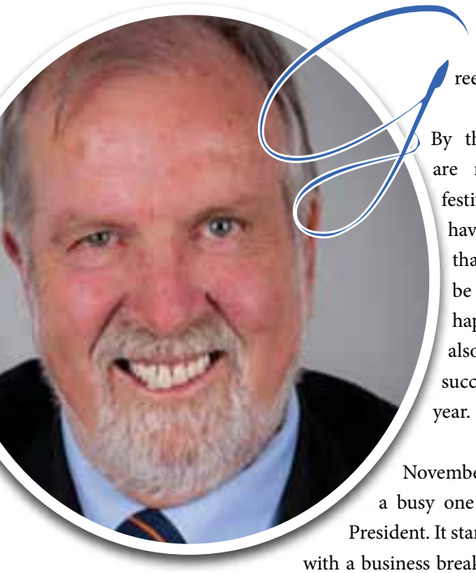
In order to expand and make this fund available to a larger group of candidates, the Institute needs to acquire more sustainable funding. The SAIEE would like to appeal to its members for assistance in the form of Corporate sponsorship or donations. The SAIEE is able to facilitate and administer the process for any company thereby eliminating any hassle or trouble in monitoring the bursary procedure.

2013 sees a year for TEN bursaries offered to students who have applied to study electrical engineering. This is the SAIEE Members' contribution to address the skills shortage in SA - funded from the SAIEE Education and Bursary Fund.

There are 25 BSc and 11 BTech applications for bursaries in the SAIEE list for companies to choose from. Interested entities will be provided with full details of any student they choose to sponsor.

More information will be published in the February 2013 issue of the **watt**now magazine and the routine wattsOn e-mail to members. Please do not wait to respond to this call. Members or any entities who would like to participate can contribute to the Education and Bursary Fund.

Please contact Dudu Madondo, SAIEE Bursary Secretary at dudum@saiee.org.za or Stan Bridgens on 011 487 3003 to find out more about this exciting initiative for corporate participation in growing the Electrical Engineering industry.



reetings to All.

By the time that you are reading this, the festive season will have passed. I hope that Christmas will be a peaceful and happy time for all. I also wish you every success for the 2013 year.

November proved to be a busy one in the life of the President. It started off on the First with a business breakfast hosted by the South African National Energy Association, and the speaker's topic was the effect of the proposed Eskom MYPD tariff increases – 16% per annum over the next 5 years. On the Fifth, Stan and I attended the President's Forum at the Engineering Council of South Africa. The President of ECSA, Mr. Cyril Gamede, as well as the CEO gave us an update of the various initiatives being carried out, including the Government's infrastructure programme, skills requirements and other issues. The Institute participates in many of these initiatives, and in most areas the "Electricals" are a strong influence.

In the same week, I attended the Power Generation Conference in Sandton, where we were media partners for the event. This conference was accredited by us for CPD points

In terms of our constitution, we have a grade of membership – Companion. Section 2.6 of our constitution defines this grade as follows: "Election to the status of Companion is by invitation of Council to any person who has rendered important services to electrical engineering in commerce, finance, law, or science." The Council had decided to bestow this honour on both Minister Naledi Pandor, the outgoing Minister of Science and Technology, and Minister Derek Hanekom, the incoming Minister. Accordingly, Stan and I travelled to the CSIR in Pretoria, and presented the certificate to Minister Hanekom. Both these two people have rendered the Institute great support in the past.

The next week, I attended the PICA awards which were presented at Emperor's Palace. (Awards presented in the publications industry) Our very own **watt**now was nominated for 3 awards. We were not successful, but this is still a wonderful achievement seeing we have been the publishers for only one year. I am sure that you will agree that Minx is to be congratulated for the nominations. The very next day, Minx organized **watt**now's "first" birthday party, which took place in the form of a business Breakfast, to which all of our advertisers were invited.

Each year the Institute runs a National Student's Competition. The major sponsor for this event is EE Publishers who sponsor R25,000.00 towards the prizes. We are also fortunate to have other sponsors for hand-outs for the participants and other expenses. This year the event was hosted by the University of Stellenbosch, and 7 Universities, and 5 Universities of Technology took part. There were 5 judges – Michael Roode from Paarl Municipality, Rod Harker (SAIEE Past President), Chris Yelland (MD EE Publishers), Stan Bridgens and myself. The projects were all of a high standard, and this was reflected by the small spread of points in the judging of the projects. Minx canvassed for papers from the participants, and a more comprehensive report can be found in the **watt**now.

The final week of November, I attended the Powering Africa summit hosted by the United Nations in Cape Town. This summit took the form of a number of panel discussions, covering subjects such as Renewables, Regulation and the like. It was attended by the Deputy Minister and Electricity Regulator from Zimbabwe, as well as the head of Nigeria's Electricity Commission, and the Regulator. The Zimbabwean Regulator has kindly provided a copy of the Minister's address to be published in **watt**now.

Finally, on the Thirtieth, my wife Margaret and I traveled down to the Kwa-Zulu SAIEE Centre, for their bi-annual dinner and awards evening. This evening was held at the Durban Country Club on a very wet night. The guest speaker from Johannesburg failed to arrive, but we were very ably entertained by the President of ECSA, Mr Cyril Gamede, who related anecdotes in his earlier life as a scholar and student. Congratulations to the Centre Chairman, TC Madikane, the SAIEE Secretary in the Centre, Gill Nortier, and the committee, for a well organized and enjoyable evening.

Mike Cary | SAIEE President 2012

WATTSHOT

In this issue, we showcase gadgets & gizmo's for everyone....

LifeProof™ Belt Clip for iPhone 4/4s

Do you need quick access to your mobile device? With the LifeProof Belt Clip you can have your LifeProof 'at the ready'. You can conveniently click-in or pull out your device with the ease of one hand. This Duo kit includes two clips - one 1.5" for "regular" belts and the other 2" wide for duty belts used in Military and emergency services such as law enforcement, fire rescue, and all tough-jobs. Your LifeProof Belt Clip for your iPhone 4/4S Case lets you take your iPhone into the boardroom, out to the streets, onto the work site, and across mountain trails.
PRICE - R390.

Golf Ball Finder Glasses

Save hours looking for your wayward golf balls with these specially tinted glasses. Aside from looking about as hip as you can get, these glasses actually serve a very useful purpose! You've finally made time for a round of golf..... but your balls keep disappearing off-piste and your stocks are running low. Don the glasses and let the special blue lenses work to illuminate everything white - including those errant long-shots. Not even the sneakiest golf balls will be able to hide away in the grass with these funky frames on the loose. Save enough time and money by retrieving all your lost balls to go another 18-holer. **PRICE** - R175.

Shocking Pen

Catch your mates out with this electrifying surprise! This novelty pen will surprise anyone that tries to use it with a harmless electric shock. If you work in an office where colleagues regularly steal your pens, this is a great way to catch them out.
The pen seems to use the normal function where you press the top to reveal the ink tip. But beware - if you click on the top button, you'll get a shock, while if you twist the pen's base, a useable ballpoint tip will emerge. As this item does emit an electrical shock, it should be used with care, and kept out of children's reach and not used by anyone fitted with a pacemaker.
FEATURES: Writable pen function; Shocks when you press top; Catches those office pen thief's; **PRICE** - R47.50

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.
FEATURES:
Blister packed, 1 x Turquoise Blue Emergency Phone Charger Adaptor Cables included, Compatible with iPods, Compact and durable, Does not include batteries
PLEASE NOTE: Unsuitable for use with the iPod Touch or iPhone. **PRICE** - R142.50.

USB Voice Recorder

Take notes or record conversations with this small and subtle USB Voice Recorder. Looking just like a USB data stick, this voice recorder is the perfect pocket-sized way to record discreetly or covertly.
It's extremely simple to operate. Just turn it on and it will immediately start recording audio to its internal memory as a WAV file. When you want to play back what you've recorded, simply plug it into a USB port on your computer to copy and save the files and then play them in the same way that you would listen to any other audio or music file.
The USB Voice Recorder charges up when you plug it into a USB port and can record for up to four hours on a single charge.
There are many possible uses for this clever little device. You can make your own notes or use it for taking dictation, or leave it hidden in plain sight to make covert recordings. No one will suspect that it's anything more than just a USB stick! **PRICE** - R525.

Mystic 8 Ball

Every house in America has a Magic 8 Ball - or so we're led to believe, based on its constant appearances in TV comedy and drama. This proliferation must mean that it truly is magic. It cannot be just a plastic polyhedron, emblazoned with all-encompassing answers, which rights itself in a pool of liquid trapped in a black bubble. All you do is ask the Magic 8 Ball a question, shake it a bit and then look to the porthole in its base for a timely and reasonable answer. Of course, the question has to be a tentative prediction of potential future happenings. 'Will that bloke in the cubicle opposite ever get rid of those IRRITATING monitor gonks?' and "will I win a ticket to next year's Currie Cup final?' are good examples of posers to set your 8 Ball. Leave one of these on your desk and people are virtually guaranteed to come and shake it. It also doubles as a paperweight. And, it looks like a giant 8 ball from pool - which is cool because, well, it just is. So as well as mapping out your life and making vital decisions for you, the Magic 8 Ball is an oversized novelty sporting whatnot. How much more do you want for your money? **PRICE** - R125.

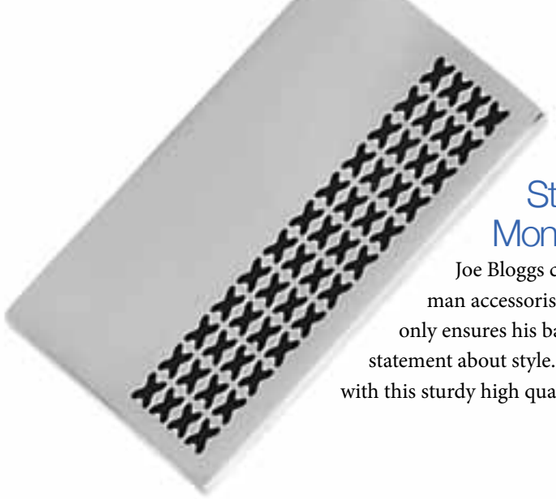
WATTSHOT

MÜHLE 4pc Mach 3 Razor Nickel Plated Shaving Set (Black)

Breath new life into your shave regime with a premium quality nickel plated shave and grooming set. Utilising your existing (and easily replaced) Gillette, Mach 3® cartridges, you can now upgrade to a more masculine and more indulgent shaving set that is guaranteed to leave you feeling invigorated, pampered and stubble-free like never before. Each set features the highest quality workmanship, and is certain to take your daily shaving ritual into the 21st century. **PRICE** - R995.

Stainless Steel 2-tone Bar Tie Clip

Not a common accessory amongst lesser men, but wearing a tie clip ensures you come across as kempt and stylish - not to mention preventing your tie from flapping out of control. **PRICE** - R275.



Stainless Steel 2-tone Criss-Cross Money Clip

Joe Bloggs carry their cash around in a wallet whereas the urban man accessorises with a sleek and debonair money clip, which not only ensures his bank notes are kept neat and tidy but also makes a statement about style. Ensure your stack of bank notes look the business with this sturdy high quality money clip. **PRICE** -R240.

Yves Saint Laurent Kouros 100ml Eau de Toilette

Kouros Eau de Toilette by Yves Saint Laurent, launched by the design house of Yves Saint Laurent in 1981, Kouros is classified as a luxurious, spicy, lavender, amber fragrance. This masculine scent possesses a blend of grass, cloves, jasmine, rose and coriander. Accompanied by a touch of vanilla and honey. It is recommended for romantic wear. **PRICE** - R760

*All products featured in the **watts**hot section are available online from www.mantality.co.za.*

WATTSUP

2012 SAIEE National Student Competition

The finalists in the National Student's Competition, are front row (l-r): Christopher Linegar (UCT), Merelda Wu (Wits), Matthew Looi (Wits), Imtiaz Mangerah (Univ. KZN), Leanne Pienaar (Univ Stellenbosch), Graham Hull (CPUT), Anton Redelinghuys (VUT). Back: Sven Grüttenmeyer (CUT), Barend Swart (NMMU), Mike Cary (SAIEE President), Albert Monteith (UP), Jaco Joubert (NWU), Jan-Christoffel Els (TUT), Renier Smit (UJ)

Winner, Albert Monteith from the University of Pretoria with SAIEE President Mike Cary and Chris Yelland, EE Publishers.

Winner, Graham Hull from the CPUT with SAIEE President Mike Cary and Chris Yelland, EE Publishers.

(L-R) Stan Bridgens(SAIEE) with Johann Treurnicht & Prof. Herman Steyn (both from Univ. of Stellenbosch) and Mike Cary.

Mike Cary with Barend Swart from the NMMU, recipient of the Judges Discretionary Prize.

Mike Cary with Leanne Pienaar from the University of Stellenbosch who received the Judges Discretionary Prize for her "Seesaw" Presentation.

Matthew Looi and Merelda Wu from Wits with Mike Cary - recipients of the Judges Discretionary Prize.

Chris Yelland and Rod Harker, sharing a light hearted moment.

Prof. Herman Steyn & Johann Treurnicht of the University of Stellenbosch, the hosts of the 2012 SAIEE National Students Competition.

Prof Ken Nixon with two supporters.

The annual 2012 SAIEE National Student Competition took place at the Stellenbosch University recently.

The presentations of the students were of an immense professional and interesting level, so that the judges had a hard time to reach an unanimous vote on the winners.

The winners of the 2012 SAIEE National Student Competition are:
Albert Monteith from the University of Pretoria with his entry of "Design of an EEG-based brain-computer interface for controlling a remote controlled toy car".

Graham Hull from the Cape Peninsula University of Technology with his entry of "Autonomous Navigation and Basic Machine vision of a Hexapod Robotic Platform".

The Judges Discretionary Prize winners are Leanne Pienaar from the University of Stellenbosch with her entry of "Seesaw". Merelda Wu and Matthew Looi, both from the University of the Witwatersrand with their entry of "Reconfigurable Solar Array for Supplying Dynamic Loads" wowed the judges and deserved their discretionary prizes.

Barend Swart from the Nelson Mandela Metropolitan University won the last discretionary prize for his presentation on "Design, construct and implement remote soil probes & a SCADA system with alarm dispatching for an adaptable self-adjusting centre pivot irrigation system."

The SAIEE would like to thank the following sponsors:

- University of Stellenbosch for their hospitality
- All the participants
- Heads of Departments of Electrical Engineering at the Universities and Universities of Technology
- University of KwaZulu-Natal – Prof Stanley Mneney
- University of Cape Town – Prof Barry Downing
- North-West University – Prof Jan de Kock
- University of Pretoria – Prof Sunil Maharaj
- University of Johannesburg – Johnson Carrol
- University of Stellenbosch – Prof WH Steyn
- University of the Witwatersrand – Prof F Takawira
- Nelson Mandela Metropolitan University – Alan Roberts
- Cape Peninsula University of Technology – Ben Groenewald
- Central University of Technology – Dr Herman Vermaak
- Tshwane University of Technology – Prof AA Jimoh
- Vaal University of Technology – Dr Christo Pienaar
- The adjudicators
- All the supporters
- EE Publishers – sponsor of the prizes and trophies
- Zest, Powertech Transformers, MultiChoice, Aberdare Cables, Actom and Siemens for their sponsorship.

Anton Redelinghuys sharing interesting facts with one of the guests on his "Camping Trailer Solar Charge" presentation.

Barend Swart with a friend.

Christopher Linegar with a friend.

WATTSUP

2012 SAIEE Presidents Luncheon

The SAIEE hosted their Past Presidents Luncheon at the prestigous Royal Johannesburg & Kensington Golf Club. It was an afternoon filled with life and laughter as they shared a few of the 'untold' stories.

SAIEE Past Presidents: Front row (l-r) Alan Meyer, Mike Crouch, Bill Calder, Stan Bridgens and John Gosling. Back row: Ron Coney, Viv Crone, du Toit Grobler, Andries Tshabalala & Mike Cary.

Bill Calder & Stan Bridgens.

Allan Meyer with Craig Smith.

Ron Coney, Andre Hoffman, Mike Crouch & Viv Crone.

Andries Tshabalala, Paul van Niekerk & Mike Cary.

Pat Naidoo & John Gosling.

Craig Smith, Minx Avrabos & Gerda Geyer.

Aberdare Cables geared up to meet National Energy Generation projects

South African power cable manufacturer Aberdare Cables, a Powertech company within the JSE-listed Altron Group, is gearing up to supply specialist cable and associated cable accessories to meet the requirements of the national Integrated Resource Plan (IRP 2010 - 2030) for South Africa that will provide an additional 9600 MW of nuclear energy; 6300 MW of coal; 17800 MW renewables; and 8900 MW of other generation sources into the national power grid by 2030.

Aberdare's Annuity Executive, Siphithi Sibeko says the Aberdare product development team is working on the development of specialist cable systems designed to meet the needs of the overall IRP plan. The company will introduce eight "green technologies" for new power generation activities that will add some 3700 MW to the national grid.

The green technologies include onshore wind (target 1850 MW), Concentrating Solar Power (CSP) 200 MW, Solar Photovoltaic (PV) 1450 MW, Biomass 12.5 MW, Biogas 12.5 MW, landfill gas 25 MW, small scale hydro electric projects 75 MW and other small projects generating 1 to 5 MW to produce a further 100 MW.

"Solar energy and onshore wind power are key elements of renewable energy generation. Electrical energy generated from solar PV installations is clean and efficient. Solar PV plants will connect to the national grid and will contribute a substantial percentage of South Africa's new electrification capacity by 2030," says Siphithi.

Expo winner now a London International Youth Science Forum counselor

2011 Eskom Expo for Young Scientists overall winner, Palesa Masuku has been appointed a counsellor at the prestigious London International Youth Science Forum (LIYSF).

In addition to being the joint winner of the Eskom Best Female Project, as part of her prize Masuku also received the opportunity to travel to the Science Forum in September 2012, which is attended annually by some of the world's best young achievers in science, technology, engineering, mathematics and innovation.

Her school, JM Ntsime High School situated in a rural area near Rustenburg, also won the Eskom Best Rural High School award and received a mobile science kit valued at over R25 000 in 2011.

The LIYSF is a unique event and opportunity for top young science students aged 17 to 21 years old from around the world. Since 1959, LIYSF has welcomed young scientists to come together to learn, exchange views and opinions and share knowledge.

Students also get the chance to visit some of the world's leading university departments and industrial sites. A key aspect of the programme is the plenary and specialist lectures hosted by some of the world's most renowned scientists who speak on a broad range of pertinent and inspiring topics.

Masuku, who wowed the Eskom Expo for Young Scientists judges last year with her idea of using marula fruit as an alternative energy source says she is "over the moon" and will be grabbing the opportunity with both hands.

"Right now I feel very proud, honoured and privileged to be part of something so great. I can't wait to play an even greater part in other scientists' lives and to help and guide them to discover their talents and exciting career paths in science," says Masuku.

Masuku, who had never been overseas before says London is not too different from South Africa but the experience was great and the opportunity to learn and share ideas with young scientists from all over the world, even better.

Her role as a LIYS counsellor in 2013 will involve helping to take care of and guide other young scientists both at Eskom Expo for Young Scientists International Science Fair and the London International Science Fair.

Dr Steve Lennon, Eskom Group Executive on Sustainability says Eskom is delighted and proud to be playing a part in grooming Masuku.

"Palesa is an excellent ambassador as she is a young person who has demonstrated a consciousness of the challenges faced by the people in her community, as well as the motivation to find creative solutions to those problems. She is also committed to helping other bright science minds such as herself and we are thrilled with her accomplishments and the maturity she has displayed since we first met her."

From (l-r), Roger Price, Angela Price, Minx Avrabos, Mike Cary, Viv Crone & Stan Bridgens.

wattnow networking event

It was with pride that we celebrated the first year of the **watt**now magazine being published within the SAIEE - and what a successfull year we had!

The guest enjoyed a scrumptious breakfast while networking and meeting up with old friends and colleagues.

The guest were entertained by Mrs Angela Price, who is married to the great-grandson of Bernard Price. She had the visitors in stitches with her reminiscence on how it was growing up with an engineer. I'm sure it was because most of our engineers could relate. Read her talk on page 46 in this issue.

Our guests did not leave empty handed due to the generosity of our sponsors; Wetherlys, Sandro Hairdressing, Avon, Pan Macmillan Publishers and Sony. Thank you very much for your generosity.

Our next Networking Breakfast will be in February 2013, watch this space.

WATTSUP

Zest WEG Group supplies packaged solution for Boteti

The Zest WEG Group has commissioned a range of equipment at Boteti Mining's AK06 opencast diamond mining project in Botswana in record time, in execution of a contract awarded by EPCM contractor DRA. The electrical equipment was supplied in the form of a group package solution and was completed six weeks ahead of schedule on this fast-track diamond mining project located near the Orapa and Letlhakane mines.

The fully autogenous grinding mill at Boteti powered by a WEG solution comprising a 4 000 kW 3.3 kV motor, a MVW01 VSD and phase shift transformer.

Boteti Mining is 100% owned by Lucara Diamond Corp, a Canadian company. Lucara's US$ 130 million Boteti AK06 project has seen the construction of a 2.5 Mtpa processing plant that will be upgraded to 4 Mtpa after four years.

"The integrated solutions we provided were custom designed for the project and our teams were closely involved in the application engineering process with DRA," Zest WEG Group's David Claassen says. *"We harnessed the synergies between the technical products offered by the Zest WEG Group to craft a solution that guaranteed critical power to the plant at all times."*

MAD Challenge winner Brennan Buitendag together with second place winners Tylor Hoffman and Unathi Chonco

South African learners go MAD for application development

More than 50 talented learners from nine Gauteng schools competed in The Mobile Application Development (MAD) Challenge, with Brennan Buitendag from Hoërskool Gerrit Maritz emerging as the winner in a tightly fought contest.

This competition was presented at the BlackBerry® apps lab at the University of Pretoria by the Department of Informatics. It forms part of a PhD research study on e-Skills development by Johan Breytenbach. The aim of the MAD Challenge was to encourage grade 10 and 11 learners to embrace the career choices and entrepreneurial potential of the ICT industry.

The competition-like nature of the MAD project, together with the strict entry requirements resulted in a high calibre of entries. Applications were judged on the creativity and entrepreneurial content of the idea behind the app, usability, functionality, completeness, business value motivation, and programming skill. Winning apps included apps with a strong education focus and apps that allow users to view and share socially relevant content on a geographic (GPS/map view) platform. The winners were awarded BlackBerry® PlayBook™ tablets for their work.

The first prize went to Brennan Buitendag from Hoërskool Gerrit Maritz for his Learners Test app, which prepares students to successfully pass their learner drivers tests. The second prize went to Tyler Hoffman and Unathi Chonco from Pretoria Boys High who developed the Live Music Guide app, which lets you find music gigs you are interested in and even helps to find your way to the event.

"It was very exciting to take part in the MAD Challenge," said winner Brennan Buitendag. "It was a great opportunity and I learned a lot. I am hoping that I'll be able to upload my app to BlackBerry App World soon and even make some money from it."

New 'green' UPS system gets highest efficiency rating

A new high-frequency, 15-120kVA, 3-phase (input and output) uninterruptible power supply (UPS) system, targeted at the protection of critical operations and processes in departmental, distributed office and small data centre applications, has been launched by local power provisioning specialist, Powermode.

The EVO Safepower HF from Powermode principal Siel is a European-manufactured and certified UPS system designed with minimal impact on its environment and upstream power sources in mind.

"The unit features an efficiency rating of 96.5%, the highest of any UPS in our range and one of the best on the market," says Powermode MD, Jack Ward. *"An efficiency rating of this order translates into significantly lower running costs with savings of around 50% in energy consumption, underpinning the manufacturer's claims of a quick return on investment and a low, long-term cost of ownership,"* he asserts.

The Siel EVO Safepower HF features a compact footprint and is designed for easy installation, especially on sites with limited power capacity available, or with generator compatibility challenges.

From a technical perspective, the unit features a low input current distortion - less than 3% - with a high input power factor of 0.99. It boasts a power 'walk-in' function to achieve progressive rectifier start-up, and a delayed start-up on mains power supply return. It also acts as a high-performance filter to protect its power supply from load-induced harmonics and reactive power.

OBITUARY

Leslie Harry James

1 October 1922 - 3 December 2012

BY I MIKE CROUCH & STAN BRIDGENS

LESLIE JAMES (Les) was born on 1 October 1922. He attended primary school in White River and Duiwelskloof. He completed his high school career at Ficksburg High School. He received his Tertiary education at Natal University where he graduated with a BSc(Elec)Eng. During World War 2 Les served in the 6th SA Armoured division in Italy.

After demobilisation, Les married Gladys Cooper on the 1st of October 1949. They were happily married for 61 years until Gladys passed away on 25 May 2012. Les and Gladys were real "characters" and were much loved and admired by all of whom had the pleasure in meeting them. Their family grew to three children, six grand children and four great grand children!

Les joined the Rand Water Board in March 1946 as a pupil engineer and rose through the ranks to become Chief Engineer of the Board in March 1979. His career at the Rand Water Board included membership of numerous National committees concerning water engineering and attended many top overseas conferences in Paris, Sydney, Stockholm, Toronto, Munich and Cincinnati. He also presented numerous high level technical papers to various Learned Societies in South Africa.

On the 2nd of July 1943, Les joined the SAIEE where he enjoyed an illustrious career which included 42 years on Council (1970 - 2012) and 28 years as Honorary Treasurer (from December 1983 to March 2011.) He was elected President of the Institute on the 25th February 1982 and received the Institutes highest award of "Honorary Fellow" on the 5th June 1987. He received the "Engineer of the Year Award" in 1997. Although Les was a committed member of the SAIEE, he was also a Fellow of the British IEE and Member of the British IMechE. Les was a registered Professional Engineer in South Africa and Chartered Engineer in Britain. The work that he has done and the legacy he has left will be remembered and enjoyed by members for many years to come.

Les James was a gentleman who called a spade a spade, and always lightened any serious debate with his wit which would disarm a Sherman tank - more importantly - his insight and wisdom.

He was always willing to take on the most arduous of tasks for the benefit of the Institute. When reporting at Council Les added that extra special quality of dignity and authority that was admired by all.

Very few Engineers have his grasp of financial matters. Les was one of the few who had both financial wisdom and strategic insight.

Les James will be sorely missed but will be remembered as a gentle man who was always ready to give wise counsel laced with a great sense of humour. In his later years, his Tuesday visits to Innes House were spent advising on the finances and keeping the Constitution of the Institute up to date.

Les we salute you for your substantial contribution and legacy to the Institute

The President, Council and Members of the SAIEE celebrate the life of Les James, the doyen of the Institute and we proffer our sincere condolences to Lynne, Dianne, Graeme and their families, at this sad time. We wish them well! wn

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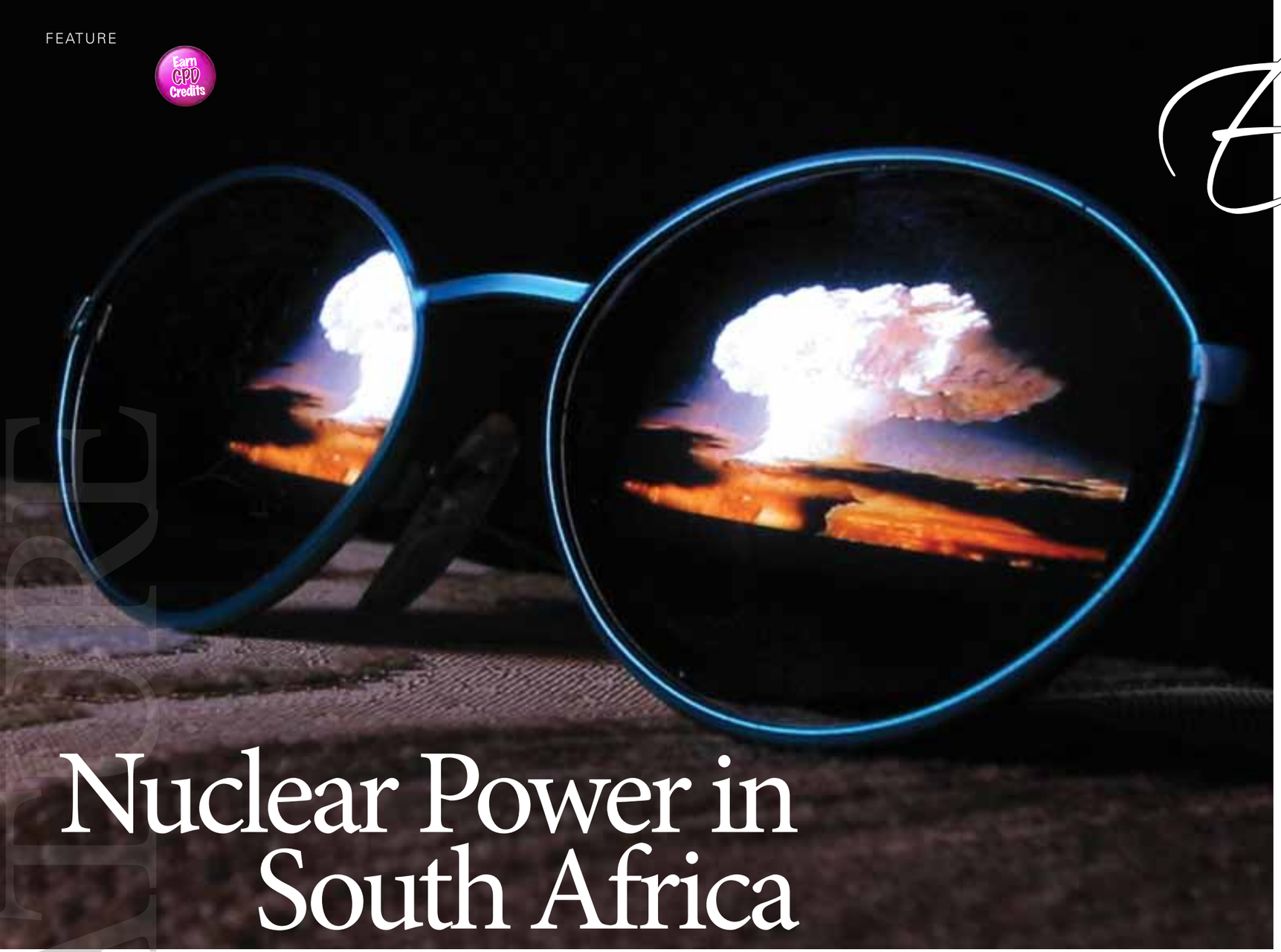

Nuclear Power in South Africa

Electricity consumption in South Africa has been growing rapidly since 1980 and the country is part of the Southern African Power Pool (SAPP), with extensive interconnections. Total installed generating capacity in the SAPP countries is 54.7 GWe, of which around 80% is South African[1], mostly coal-fired, and largely under the control of the state utility Eskom.

COMPILED BY I MINX AVRABOS

Eskom supplies about 95% of South Africa's electricity and approximately 45% of Africa's. Of its total installed net capacity of 40.5 GWe (44.2 GWe gross), coal-fired stations account for 34.3 GWe and nuclear 1.8 GWe[2]. Early in 2008, demand in South Africa was uncomfortably close to this[a].

In 2008, Eskom power stations produced 230.0 billion kWh (TWh) of electricity (out of total South African electricity production of 239.5 TWh), of which the Koeberg nuclear plant generated 12.7 TWh – about 5.3% of total South African generation[3].

Over the five years to March 2013, Eskom planned to spend R385 billion (around US$ 50 billion) on new capacity – mainly coal- and gas-fired plants, as well as on returning mothballed coal-fired stations to service. Eskom said the country needs 40 GWe of new generation by 2025, about half of which should be nuclear. In the meantime the country remains heavily dependent on coal, with power plants built near the mines, and the two largest coal-fired plants in the world under construction - 4800 MWe each. Also the country gets 40% of its oil/gasoline needs from coal-to-liquids plants.

In October 2010, the Department of Energy released its draft Integrated Electricity Resource Plan (IRP) for 2010-2030. The IRP outlines the country's electricity demand, how this demand might be supplied, and what it is likely to cost. Its balanced scenario represents the best trade-off between least-investment cost, climate change mitigation, diversity of supply, localization, and regional development. The IRP requires 52 GWe of new capacity by 2030, assuming 3.4 GWe of demand-side savings. After public consultation the IRP was revised early in 2011 and passed by cabinet in March. According to this scenario, South Africa's generation mix by 2030 should include: 48% coal; 13.4% nuclear; 6.5% hydro, 14.5% other renewables; and 11% peaking open cycle gas turbine. Although nuclear is included in the energy mix only from 2023, a decision on this "must be finalized as quickly as possible" and a procurement process set up. At least 9.6 MWe new nuclear capacity by 2030 is included in the plan confirmed in mid 2011, significantly less than the 2007 target.

In the May 2011 budget speech the energy minister reaffirmed that 22% of new generating capacity by 2030 would be nuclear and 14% coal-fired. The budget also provided R586 million ($85 million) for the Nuclear Energy Corporation of South Africa (NECSA) "to continue with its central role as the anchor for nuclear energy research and development and innovation."

OPERATING SOUTH AFRICAN POWER REACTORS

Reactor	Type	Net capacity	First power
Koeberg 1	PWR	900 MWe	1984
Koeberg 2	PWR	900 MWe	1985
Total (2)		1800 MWe	

NUCLEAR INDUSTRY DEVELOPMENT IN SOUTH AFRICA

South Africa's main coal reserves are concentrated in Mpumalanga in the northeast, while much of the load is on the coast near Cape Town and Durban. Moving either coal or electricity long distance is inefficient, so it was decided in the mid-1970s to build some 1800 MWe of nuclear capacity at Koeberg near Cape Town.

The Koeberg plant was built by Framatome (now Areva) and commissioned in 1984-85. It is owned and operated by Eskom and has twin 900 MWe (940 MWe gross) pressurised water reactors (PWRs), the same as those providing most of France's electricity.

While there had been no intention to build further power stations of this type, the government announced early in 2006

Nuclear Power in South Africa

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The environmental impact assessment (EIA) process initiated in 2006 confirmed the selection of three possible sites for the next nuclear power units...

that it was considering building a further conventional nuclear plant, possibly at Koeberg, to boost supplies in the Cape province.

Early in 2007, the Eskom board approved a plan to double generating capacity to 80 GWe by 2025, including construction of 20 GWe of new nuclear capacity so that nuclear contribution to power would rise from 5% to more than 25% and coal's contribution would fall from 87% to below 70%. The new program would start with up to 4 GWe of PWR capacity to be built from about 2010, with the first unit commissioned in 2016. The environmental assessment process for the so-called 'Nuclear-1' project considering five sites, and selection of technology was to follow in 2008.

Areva's EPR and Westinghouse AP1000 were short-listed. Areva headed a consortium of South African engineering group Aveng, the French construction group Bouygues and EDF which submitted a bid to supply two 1600 MWe EPR units.

Westinghouse matched this with a bid of three 1134 MWe AP1000 units. The Westinghouse-led consortium included The Shaw Group and the South African engineering firm Murray & Roberts.

Areva and Westinghouse also offered to build the full 20 GWe – with a further ten large EPR units or 17 AP1000 units by 2025.

This would have been coupled with wider assistance for the local nuclear industry, in the Westinghouse case including development of the Pebble Bed Modular Reactor (Westinghouse was an investor in the PBMR company and also sponsored the design in the USA – see section on PBMR).

However, in December 2008, Eskom announced that it would not proceed with either of the bids from Areva and Westinghouse, due to lack of finance, and the government confirmed a delay of several years[4].

PROPOSED SOUTH AFRICAN POWER REACTORS

Reactor	Type	Gross capacity	First power
Thyspunt (total 6 or more)	PWR	9600 MWe	2023-2030

In the Draft Integrated Electricity Resource Plan for South Africa – 2010 to 2030[5], nuclear prospects were revived, for 9600 MWe, supplying 23% of the electricity. Although the draft plan includes six new 1600 MWe reactors coming online in 18-month intervals from 2023, Eskom has said that it would be looking for lower-cost options than the earlier AP1000 or EPR proposals, and would consider Generation II designs from China (perhaps CPR-1000) or South Korea (perhaps OPR).

The capital cost per installed MWe of a CPR-1000 is said to be about half that of an AP1000 or EPR. Before approval, a safety report for the selected specific design must be submitted to the National Nuclear Regulator for evaluation and approval and a nuclear installation licence obtained. Following the Fukushima accident it is likely that a Gen III design will be favoured. Early in 2011 Areva stepped up its involvement with the Nuclear Energy Corporation of South Africa (NECSA).

Bids are expected to be called early in 2014 so that the contractor/vendor is on site in 2016, with a view to 2023 operation of the first unit. Initially about 30% local content is expected in the project, rising to 40% later.

The environmental impact assessment (EIA) process initiated in 2006 confirmed the selection of three possible sites for the next nuclear power units: Thyspunt, Bantamsklip, and Duynefontein, the last of which is very near the existing Koeberg nuclear plant. All are in the Cape region and were subject to further assessment.

A draft environmental impact report (EIR) was published in March 2010 recommending the Thyspunt site in Eastern Cape province near Oyster Bay. A final EIR was to be submitted to the Department of Environmental Affairs early in 2011.

A Renewable Energy Plan launched in October 2011 calls for 17,800 MWe of "green" energy by 2030, and invites tenders for 1450 MWe of solar PV, 200 MWe of CSP, 1850 MWe of wind power, and various smaller contributions, total US$ 11 billion.

In December 2011 the energy minister said that some $50 billion would be spent on nuclear capacity to 2030. A National Development Plan then cast doubt on nuclear power's financial viability, but in November 2012 the cabinet endorsed a *"phased decision-making approach for implementation of the nuclear programme"*, along with the *"designation of Eskom as the owner-operator as per the Nuclear Energy Policy of 2008"*.

PBMR

Over 1993 to 2010, Eskom (in collaboration with others since 1999[b]) was developing the Pebble Bed Modular Reactor (PBMR). It is a high-temperature gas-cooled reactor (HTR) design, for both electricity generation (through a steam turbine or direct cycle) and process heat applications.

From 1999 to 2009, the South African government, Eskom, Westinghouse, and the Industrial Development Corporation of South Africa invested R9.244 billion (about US$ 1.3 billion) in the project[c].

In September 2010, the Minister of Public Enterprises announced that the Government would stop investing in the PBMR[6]. The Minister gave the following reasons for this decision:

- No customer for the PBMR had been secured.
- In addition to the R9.244 billion ($1.3 billion) already invested in the project over the previous decade, a further R30 billion ($4.2 billion) or more was needed.
- The project has consistently missed deadlines.
- The opportunity to participate in the USA's Next Generation Nuclear Plant (NGNP) program had been lost.
- Any new nuclear build program in South Africa would use Generation II or III technology. (The PBMR is considered a Generation IV technology.)
- Government spending had to be reprioritized in the light of the economic downturn.

The project had received a certain amount of interest, but not enough to secure the financing it required. The domestic need in South Africa is for larger units.

URANIUM MINING IN SOUTH AFRICA

Uranium production in South Africa has generally been a by-product of gold or copper mining. In 1951, a company was formed to exploit the uranium-rich slurries from gold mining and in 1967 this function was taken over by Nuclear Fuels Corporation of South Africa (Nufcor), which in 1998 became a subsidiary of AngloGold Ltd. It produces over 600 tonnes U3O8 per year from uranium slurries trucked in from various gold mines and Palabora copper mine. In May 2009 AngloGold announced plans to construct a new uranium recovery plant at its Kopanang mine to lift production to 900 t/yr from 2012. AngloGold in July 2011 said it would take a 19.79% stake in First Uranium Corp, with operations at Ezulwini and Buffelsfontein for $29 million.

DOMINION REEFS

In 2006, Uranium One[i] obtained its mining right for the Dominion Reefs project at Haartebeesfontein, outside Klerksdorp, 150 km southwest of Johannesburg. Production commenced early in 2007 and was planned to increase to 1730 t/yr U3O8 by 2011. Production cost was earlier expected to be US$ 14.50/lb U3O8 from the conglomerate reefs to 500 metres depth, but evidently increased well beyond this. The first sales contract for 680 tonnes was announced in November 2006. Production in 2007 was 78 tonnes and that for 2008 was 86 tonnes U3O8, reflecting slower and more difficult underground development than anticipated. A small amount of uranium was purchased from Australia in 2008 to meet sales commitments.

Dominion has indicated resources of 51,000 tonnes U3O8 at 0.063% and inferred resources of 62,800 tonnes U3O8 at 0.036%. Within these, reserves however are only 14,240 tonnes at 0.077% and with US$ 46.50/lb production cost. The mine was closed in October 2008 due to a labour dispute coupled with power shortages and increased project costs in the context of lower uranium spot prices. The mine was then put on care and maintenance. Uranium One sold it in April 2010 for $37 million to Shiva Uranium, a company with Indian and South African shareholders, which resumed uranium production early in 2011.

RYST KUIL

In February 2007, UraMin Inc increased its stake in the Ryst Kuil uranium project in the central Karoo Basin on the border of East and West Cape provinces to 74%. The company was then taken over by Areva to become Areva Resources Southern Africa. The deposit was discovered by Esso in the 1970s. Some 19,000 tonnes U3O8 resources (16,000 tU) are estimated on historic basis at 0.1% grade, and two further leases under application will lift this to 29,000 tonnes (24,600 tU). Mine production of 1350 t U3O8 per year was projected by the end of 2009 but this has been delayed. A full feasibility study is being carried out.

EZULWINI

First Uranium Corp of Canada, has built a US$ 55 million uranium processing plant at Ezulwini gold-uranium mine, 40 km southwest of Johannesburg, which has 3200 tU in measured and indicated resources and 85,000 tU inferred resources. The main part of the plant, part of a $280 million recommissioning project, was completed and the first uranium produced in May 2009. Calcining is off-site. A seven-year ramp-up of underground production from the Middle Elsburg reef was planned, though this is on hold as the plant was placed on care and maintenance in February 2012. FY 2012 production (to end March) was 34 tU. The mine earlier produced over 6000 tU from 1960s to 2001. Early in 2012 Gold One International agreed to buy the

Nuclear Power in South Africa

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The South African nuclear industry dates back to the mid-1940s, when the predecessor organisation to the Atomic Energy Corporation (AEC) was formed.

operation for $70 million. Another offer was received from Waterpan Mining Corp. Gold One plans to recommission the plant by March 2013, to treat both gold and uranium separately. The mine will form part of the company's Cooke underground operations.

BUFFELSFONTEIN - MINE WASTE SOLUTIONS

First Uranium has been building a larger $260 million uranium processing plant at the Buffelsfontein gold mine 160 km from Johannesburg which has some 21,000 tU as proven and probable reserves in old mine tailings – its Mine Waste Solutions (MWS) project. Uranium production is expected to be 600 tU/yr over 16 years at full capacity, ramping up to 350 tU/yr from late 2010. A new plant is due to be commissioned in mid 2012. The provincial government in July 2009 approved construction of a new tailings storage facility for MWS.

The National Nuclear Regulator has had concerns with the pipeline to the new tailings facility. Gold production continues at the site. Early in 2012 AngloGold Ashanti agreed to buy the operation for $335 million.

Both the Ezulwini and MWS operations are in the Klerksdorp area southwest of Johannesburg and in 2008 First Uranium announced plans to build an acid plant using pyrite from MWS and 30 MWe of power generating capacity to service the two operations.

RANDFONTEIN

Nearby, Rand Uranium was spun off from Harmony Gold Mining Co and is reopening part of the Randfontein mine which produced uranium in the 1980s. It has identified JORC-compliant resources of some 41,000 tU both in tailings and underground. This includes probable reserves of 15,200 tU in the Cooke tailings. Production at 1000 tU/yr is envisaged. Pamzodi Resources, South Africa's largest private equity fund, agreed to take a 60% share in the new company for US$ 420 million, but this was later reduced to $348 million. Following a feasibility study, a US$ 470 million treatment plant to produce 960 tU/yr mostly from Cooke tailings is planned. First production is expected mid-2012.

HENKRIES

The Henkries uranium project is being explored by Namakwa Uranium, which is now owned 74% by Niger Uranium and 26% by the company's black economic development partner, Gilstra Exploration. Anglo American did a feasibility study on the project in 1979.

FUEL CYCLE, HISTORICAL R&D

Eskom procures conversion, enrichment and fuel fabrication services on world markets. Nearly half of its enrichment is from Tenex, in Russia. However, historically South Africa has sought self-sufficiency in its fuel cycle.

The South African nuclear industry dates back to the mid-1940s, when the predecessor organisation to the Atomic Energy Corporation (AEC) was formed[j]. In 1959, the government approved the creation of a domestic nuclear industry and planning began the next year on building a research reactor, in cooperation with the US Atoms for Peace program. The Pelindaba site near Pretoria was established in 1961, and the 20 MWt Safari-1 reactor there went critical in 1965[k]. In 1970, the Uranium Enrichment Corporation (UCOR) was established as South Africa commenced an extensive nuclear fuel cycle program, as well as the development of a nuclear weapons capability. In 1985, UCOR was incorporated into the AEC, which was restructured to become the South African Nuclear Energy Corporation (Necsa) as a state-owned public company in 1999.

A 1200 tU/yr conversion plant was established and ran in the 1980-90s.

Enrichment was undertaken at Valindaba (also referred to as Pelindaba East) adjacent to the Pelindaba site by the unique Helikon aerodynamic vortex tube process developed in South Africa, based on a German design. Construction of the Y-Plant pilot uranium enrichment plant commenced in 1971 and was completed in 1975 by UCOR. At this time, the USA stopped exporting highly enriched uranium (HEU) fuel for the Safari-1 reactor in protest against the construction of Y-Plant and South Africa's nuclear weapons program. Due to technical problems, Y-Plant only started producing 45%-enriched uranium in 1979 and in 1981 the first fuel assemblies for Safari-1 from Valindaba were fabricated. Operations at Y-Plant ceased in 1990 and the plant has been dismantled under International Atomic Energy Agency (IAEA) supervision.

On the neighbouring Pelindaba site, construction on a semi-commercial enrichment plant commenced in the late 1970s. This Z-Plant began commissioning in 1984, with full production in 1988. It had a capacity of 300,000 SWU/yr and supplied 3.25%-enriched uranium for the Koeberg plant. (Originally fuel for Koeberg was imported, but at the height of sanctions[l] the AEC was asked to set up and operate conversion, enrichment and fuel manufacturing services.) Z-Plant was uneconomic and closed in 1995. It has been fully demolished.

Both centrifuge and molecular laser isotope processes were also being explored. Construction of the prototype module for the Molecular Laser Isotope Separation (MLIS) project was carried out in the Y-Plant building. The MLIS program started in 1983 and was joined by Cogema of France in a 50:50 funding arrangement in 1995. In 1997 the program was cancelled due to technological difficulties and AEC budget cuts.

The BEVA fuel fabrication plant with 100 t/yr capacity operated in 1980-90s and supplied 330 PWR fuel assemblies for the Koeberg reactors.

A pebble fuel plant at Pelindaba was planned. Meanwhile, in December 2008, PBMR's pilot fuel plant manufactured 9.6% enriched fuel particles, which were shipped to the USA for testing at the Idaho National Laboratory. In August 2009, PBMR (Pty) shipped 16 graphite spheres (containing 9.6%-enriched fuel particles) to Russia for irradiation tests to demonstrate the fuel's integrity under reactor conditions. The irradiation tests, conducted by the Institute of Nuclear Materials in Zarechny near Ekaterinburg, were the final step in the development of the fuel for the PBMR demonstration unit.

A 2007 draft nuclear energy policy outlined an ambitious program to develop all aspects of the nuclear fuel cycle, including a return to conversion, enrichment, fuel fabrication and also reprocessing of used fuel as strategic priorities related to energy security. A new 5.0 to 10.0 million SWU/yr centrifuge enrichment plant built in partnership with Areva, Urenco or Tenex was envisaged, the larger version allowing scope for exports. These ideas seem to have faded but with 9600 MW of new capacity being built a significant level of local content in fuel cycle services is anticipated.

In 2012, the vision was for 1800 tU/yr conversion plant, 1.3 million SWU/yr enrichment plant and 200 tU/yr fuel fabrication plant, all established at one fuel cycle site from 2016. The conversion capacity might involve re-commissioning the old plant, or an international joint venture to commission in 2026. Enrichment would be by centrifuge, possibly with international partner, to commission 2026-257. Fuel fabrication would be in partnership with the new NPP vendor, commissioning in 2023-25.

RESEARCH & DEVELOPMENT TODAY

Necsa was established from AEC as a public company under the 1999 Nuclear Energy Act, and is wholly owned by the State. Its main functions are to undertake and promote research and development in the field of nuclear energy and radiation sciences and technology, and to process source material, special nuclear material and restricted material.

Necsa operates the 20 MWt Safari-1 reactor at its Pelindaba nuclear research centre. Safari-1 is the main supplier of medical radioisotopes in Africa and can supply up to 25% of the world's molybdenum-99 needs. By 2009 the reactor was converted from using HEU to low enriched uranium (LEU) fuel[7], and conversion of the targets used for radioisotope production from HEU to LEU was achieved in 2010.[8]

Following this, Necsa and its subsidiary NTP Radioisotopes (Pty) Ltd in October 2010 were awarded a $25 million contract by the US Department of Energy's (DoE's) National Nuclear Security Administration (NNSA) to supply Mo-99.

The commercial-scale production of the medical isotope from low-enriched uranium will be in collaboration with the Australian Nuclear Science and Technology Organization (ANSTO), whose 20 MWt Opal reactor also uses LEU fuel and targets for Mo-99 production.

With the end of operating life of Safari in sight, proposals have been for Dedicated Isotope Production Reactor (DIPR) and, with more probability, a new research reactor which includes isotope production among other roles.

Klydon Corporation, which emerged from the AEC, has been developing its Aerodynamic Separation Process (ASP) employing so-called stationary-wall centrifuges with UF6 injected tangentially. It is based on Helikon but, pending regulatory authorisation from Necsa, has not yet been tested on UF6 – only light isotopes such as silicon[m], which it is evidently most suited to. Klydon Element 92 Division is focused on uranium prospects, while its Stable Isotopes Division is concerned with silicon-28, zirconium-90 and medical isotopes.

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The Department of Environmental Affairs is responsible for environmental assessment of projects...

RADIOACTIVE WASTE MANAGEMENT

The 2008 National Radioactive Waste Disposal Institute Act provides for the establishment of a National Radioactive Waste Disposal Institute which will manage radioactive waste disposal in South Africa. The responsibility for nuclear waste disposal has been discharged by Necsa until now.

Necsa has been operating the national repository for low- and intermediate-level wastes at Vaalputs in the Northern Cape province. This was commissioned in 1986 for wastes from Koeberg and is financed by fees paid by Eskom. Some low- and intermediate-level waste from hospitals, industry and Necsa itself is disposed of at Necsa's Pelindaba site.

Used fuel is stored at Koeberg. In August 2008, the nuclear safety director of the Minerals and Energy department announced that Eskom would seek commercial arrangements to reprocess its used fuel overseas and utilize the resulting mixed oxide (MOX) fuel.

REGULATION AND SAFETY

In 1948, the Atomic Energy Act created the Atomic Energy Board, which later became the Atomic Energy Corporation (AEC). In 1963, the Nuclear Installations Act provided for licensing and in 1982 the Nuclear Energy Act made the AEC responsible for all nuclear matters including enrichment. An amendment to it created the autonomous Council for Nuclear Safety, responsible for licensing.

The Nuclear Energy Act of 1999 gives responsibility to the Minister of Minerals & Energy for nuclear power generation, management of radioactive wastes and the country's international commitments. The South African Nuclear Energy Corporation (Necsa) is a state corporation established from the AEC under the Act, and is responsible for most nuclear energy matters including wastes and safeguards.

The National Nuclear Regulator Act of 1999 sets up the National Nuclear Regulator (NNR) – previously the Council for Nuclear Safety – covering the full fuel cycle from mining to waste disposal.

The Department of Minerals and Energy (DME) has overall responsibility for nuclear energy and administers the above Acts.

The Department of Environmental Affairs is responsible for environmental assessment of projects, and has a cooperative agreement with the National Nuclear Regulator for nuclear projects.

NON-PROLIFERATION

South Africa is the only country to develop nuclear weapons and voluntarily give them up. It embarked on a nuclear weapons program around 1970 and had a nuclear device ready by the end of the decade. The weapons program was terminated by President F. W. de Klerk in 1990 and, in 1991, the country signed the Nuclear Non-Proliferation Treaty (NPT).

In 1993, de Klerk announced that six nuclear weapons and a seventh uncompleted one had been dismantled. In 1995, the International Atomic Energy Agency (IAEA) was able to declare that it was satisfied all materials were accounted for and the weapons program had been terminated and dismantled.

In 1996, South Africa signed the African Nuclear Weapon Free Zone Treaty – also called the Pelindaba Treaty. In 2002, the country signed the Additional Protocol in relation to its safeguards agreements with the IAEA. South Africa is member of the Nuclear Suppliers' Group.

NOTES

a. In January 2008, Eskom was forced to curtail power exports as well as introduce load shedding. The reserve margin of the electricity system was around 5% in January 2008 but by January 2009 the reserve margin had recovered to about 14%. This was due to economic slowdown, and hence lower electricity demand, as well as the recovery of coal-related problems experienced by the company in early 2008.

b. Eskom holds all the shares in the PBMR company, PBMR (Pty) Ltd., but several investment partners have provided financing for the feasibility stage of the project. In June 2000, the UK's British Nuclear Fuels Limited (BNFL) took a 22.5% stake in the venture. Soon after, US utility PECO (later Exelon, following the merger with Commonwealth Edison) took a 12.5% stake. The South African government-owned Industrial Development Corporation (IDC) took 25%, leaving Eskom with 40%, of which 10% was reserved (but never taken up) for an Economic Empowerment Entity. Exelon withdrew from the project in April 2002. Also, around the same time, BNFL reduced its stake to 15%, and IDC reduced its to 13%. In 2006, BNFL's 15% stake was transferred to its Westinghouse subsidiary, which was later sold to Toshiba.

Under an investors' agreement made in 2005, BNFL/Westinghouse had a 15% stake, IDC 14%, the South African government 30%, leaving Eskom with 41%. These shares were expected to move to 4% Westinghouse, 15% IDC, 30% South African government and 5% Eskom by 2012, with 46% being held by another investor. However, in August 2006, this agreement lapsed and a new agreement could not be reached. (Had a new investors' agreement been reached, Westinghouse would have had rights to 5% of the company, the South African Industrial Development Corporation to 5%, and 81% for the government, leaving Eskom with 9%.)

Although PBMR (Pty) Ltd continued to list its investors as the South African government, IDC, Westinghouse and Eskom, its funding following the completion of the feasibility stage in 2004 was principally from the South African government (through its Department of Public Enterprises). In March 2010, the government drastically cut funding for the PBMR, then in September 2010 it announced that all funding was to be cut.

c. Of the R9.244 billion (about US$ 1.3 billion) invested in the PBMR project, the South African government contributed 80.3%, Eskom 8.8%, Westinghouse 4.9%, the Industrial Development Corporation of South Africa 4.9%, and Exelon 1.1%. Figures given by Barbara Hogan, Minister of Public Enterprises, to the National Assembly on 16 September 2010 (see Reference 9 below).

d. Developed from the 200 MWt Siemens/ Interatom HTR-Modul reactor design, the initial PBMR was a 268 MWt (110 MWe) design. In order to lower the capital costs of the plant, relatively minor changes led to a 302 MWt design. However, as a result of issues arising during more detailed analysis, in 2002 it was decided that a complete review of the design was to be carried out. This resulted in the 400 MWt (165 MWe) version with a fixed central reflector in the core (the 268 MWt design has a dynamic central reflector column of graphite spheres). In addition, the power conversion unit was changed from three-shaft vertical to single-shaft horizontal turbine-compressor configuration. Reactor outlet temperature is 900°C.6

e. In 2009, the PBMR company announced it had decided to focus on a 200 MWt (80 MWe) design for the PBMR rather than the 400 MWt version (see Note d above). The 200 MWt version uses a conventional Rankine cycle to deliver super-heated steam (750°C) through a steam generator for electricity generation and process heat applications.

f. Construction of the 400 MWt demonstration plant was originally envisaged to commence in April 2007 but, partly due to delays in licensing, was put back to 2009. Later, following the decision in 2009 to focus on the 200 MWt PBMR design, the construction schedule was delayed indefinitely. A total of R 1 billion was spent on equipment, including R 268 million of reactor vessel parts made by Spain's Equipos Nucleares.

In 2003, the South African Department of Environmental Affairs and Tourism (DEAT) issued positive Record of Decisions on the environmental impact assessment (EIA) studies for the PBMR demonstration module and pilot fuel plant. However, these decisions were set aside by the Cape High Court following appeals from anti-nuclear group Earthlife Africa. This ruling, along with design changes to the PBMR – the Brayton cycle turbine design was simplified from 3-shaft vertical to single shaft horizontal configuration and the reactor capacity increased from 302 MWt to 400 MWt (see Note d above) – led to the decision to enter into a new EIA process for the demonstration PBMR. This process remains unfinished and is not likely to be completed in light of the change to a 200 MWt version of the PBMR - and the subsequent cancellation of funding in 2010. In January 2007, the Minister of Environmental Affairs and Tourism upheld the positive Record of Decision for the pilot fuel plant EIA.

Several contracts for the 400 MWt design had been awarded. In April 2005, PBMR (Pty) awarded a US$ 20 million contract to Uhde, a local subsidiary of Germany's Thyssenkrupp Engineering, to build a plant at Pelindaba near Pretoria to manufacture the fuel pebbles for the planned demonstration PBMR. The fuel plant was expected to be completed by 2010 but was delayed by regulatory issues. In August 2008, a contract was awarded to the joint venture company Murray & Roberts SNC-Lavalin Nuclear (Pty) Ltd for the provision of engineering, procurement, project and construction management (EPCM) services for the demonstration PBMR plant, then envisaged to be at Koeberg.

Nuclear Power in South Africa

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In 1944, the USA and UK requested forecasts from South Africa on its potential to supply mineable uranium.

g. In September 2010, Barbara Hogan, South African Minister of Public Enterprises, told the National Assembly that one reason for the withdrawal of government support for the PBMR was: "The opportunity afforded to PBMR to participate in the USA's Next Generation Nuclear Plant (NGNP) program as part of the Westinghouse consortium was lost in May this year when Westinghouse withdrew from the program" (see Reference 9 below). In fact, Westinghouse did not withdraw from the NGNP project, but did withdraw from the conceptual design phase (sometimes referred to as Phase 1). Following Hogan's September announcement, Westinghouse released a statement which it says was made in May 2010 by Kate Jackson, Senior Vice President of Research and Technology and Chief Technology Officer of Westinghouse: "In early March, the team of Westinghouse, PBMR (Pty) and Shaw Group was selected by the Department of Energy (DOE) to negotiate an award under a funding opportunity announcement for Phase 1 of the DOE's NGNP project. Since that time, the team has not been able to reach agreement on a way forward, and therefore, will not participate together in this project phase."

h. The small operating HTR-10 research reactor at China's Tsinghua University is the basis of the 250 MWt (105 MWe) HTR-PM reactor (one 210 MWe module consisting of twin reactor units driving a single steam turbine), which also derives from the earlier German development.

i. See the Uranium One website (www.uranium1.com)

j. In 1944, the USA and UK requested forecasts from South Africa on its potential to supply mineable uranium. This led to the formation of the Uranium Committee in 1945, and, in 1948, the Atomic Energy Board (AEB) was formally established to oversee uranium production and trade. In 1959, research, development and utilisation of nuclear technology was added to AEB's remit. In 1970, the Uranium Enrichment Corporation (UCOR) was established, initiating an extensive fuel cycle program. In 1982, the AEB was re-established as the Nuclear Development Corporation of South Africa (NUCOR) under a new controlling body – the Atomic Energy Corporation of South Africa (AEC). In 1985, UCOR was incorporated into the AEC. The South African Nuclear Energy Corporation (NECSA) was formed out of the AEC in 1999.

k. The Safari-1 (South African Fundamental Atomic Research Installation) reactor initially operated at 6.75 MW and was upgraded to 20 MW in 1968. The pool-type reactor is an Oak Ridge National Laboratory (ORNL) design fuelled by highly enriched uranium (HEU). A program to convert to low enriched uranium (LEU) fuel commenced in 2006.

l. South Africa's policy of apartheid – which ended with the 27 April 1994 general election – attracted extensive international sanctions. However, it was not until the late 1970s/early 1980s that international pressure intensified, culminating in 1985-1991 with trade sanctions by the USA, British Commonwealth and Europe, as well as disinvestment campaigns in many countries.

m. Extrapolating from test results, ASP is expected to have an enrichment factor in each unit of 1.10 (cf 1.03 in Helikon) with about 1000 kWh/SWU. Development of it is aiming for 1.15 enrichment factor and less than 500 kWh/SWU (compared with about 10,000 kWh/SWU in the Z-plant). However, to achieve gas speeds sufficient for enrichment, heavy elements such as uranium need to be greatly diluted with hydrogen, and the process appear uneconomic for uranium. wn

REFERENCES

1. Southern African Power Pool Statistics 2008
2. Eskom Holdings Limited, Annual Report 2009, p. 226
3. Total generation figures taken from Electricity generated and available for distribution (Preliminary), Statistics South Africa, Statistical release P4141 (December 2009); nuclear generation from Nuclear Power Reactors in the World, International Atomic Energy Agency, Reference Data Series No. 2, 2009 Edition (ISBN: 9789201058096)
4. Eskom shelves new nuclear project, World Nuclear News (5 December 2008)
5. Integrated Resource Plan for Electricity Draft Report, 2010, Revision 2, Republic of South Africa Department of Energy (8 October 2010)
6. Address by the Minister of Public Enterprises, Barbara Hogan, to the National Assembly, on the Pebble Bed Modular Reactor, Department of Public Enterprises press release (16 September 2010)
7. Nuclear Reactor Uses Only Low Enriched Uranium (LEU) for the First Time, South African Nuclear Energy Corporation media release (29 June 2009). See also announcement from 2005: Minister of Minerals and Energy announces the phasing out of the use of High Enriched Uranium for the Pelindaba Research Reactor Nuclear Fuel, Department of Minerals and Energy statement (18 July 2005)
8. South African radioisotope production on target, World Nuclear News (17 September 2010)
   Integrated Resource Plan for Electricity 2010-2030, revision 2, final report, March 2011.

GENERAL SOURCES

- International Atomic Energy Agency, Country Nuclear Power Profiles: South Africa
- South African Nuclear Energy Corporation website (www.necsa.co.za)
- PBMR (Pty) Ltd. website (www.pbmr.co.za)
- Eskom website (www.eskom.co.za)
- State Owned Enterprises page on the Department of Public Enterprises website (www.dpe.gov.za)

Enhancing Services with Intelligent Automation

BY | DR DAVID H JACOBSON **|** PAST PRESIDENT **|** SAIEE

In this thought leadership paper, we introduce and explain advances in software and hardware that enable systems and devices to control their actions autonomously and intelligently. These fascinating robotic developments are leading to unprecedented enhancements of services, and entirely new ones, in disparate industries, including mobile communication, cloud computing, enterprise management, collaborative buying, education and training, healthcare, mining and excavation, defence, retail and real estate. Trends are identified that will have widespread, positive effects on innovation, productivity, efficiency, investment and cost reduction during the next two to five years.

Private and public sector C-suites and boards of directors will find the trends and insights informative, thought-provoking and helpful in developing strategies and tactics for enhancing services to increase business performance and customer satisfaction.

Enhancing services using machinery began in earnest in the industrial revolution of the late 18th and early 19th centuries. Later, as electronic computers emerged and became accessible, services in society and business transformed to a significantly higher level of capability. Today we enjoy the versatility and speed of response of many of these advances.

In the following sections we review early and current instances of services enhancement and then focus on important service trends in several industries. These trends will be of particular interest and use to enterprise decision makers in:

- Obtaining appropriate services from external providers;
- Enhancing internal services;
- Developing new services for the enterprise and its customers.

EARLY SERVICES ENHANCEMENT

An early example of a computer-based service useful to all who drive vehicles, ride and walk is that provided by the ubiquitous traffic light. At first, traffic lights were rather simpleminded; they operated using a very basic computer, not more than a timer determining the on/off cycles of coloured lights. Additional features were added including sensors in the road or video cameras to alter the time cycles adaptively, depending on traffic patterns. Later, traffic lights at several intersections could be networked either using wireline or wireless connections allowing central decisions and synchronization to improve traffic flows. Toronto purportedly was the first city to computerize its entire traffic signal system in 1963.

Another early example of technology enhancing services was automatic access control to buildings by electronic cards inserted into, or touched onto, electronic readers to allow entry.

In computer integrated manufacturing (CIM) there is a long history of using pre-programmed numerically controlled (NC) machine tools to automatically produce complex parts. The controls evolved from mechanically-implemented logic into computerized numerically controlled machines (CNC) programmable and configurable from remote consoles, greatly increasing their versatility. Many types of ingenious machines such as welding robots and conveyer-belt networks, assemble, move and pack products ranging from foods to automobiles.

In mission-critical computer systems we have become accustomed to hardware and software that automatically request serviceperson assistance when inbuilt monitors detect irregularities in their operation. Some have internal "brains" competent enough to decide for themselves whether to switch-in alternative pieces of hardware and modules of software to "self heal" specific faults. Commercial cold storage equipment has the ability to autonomously call for service help, thereby avoiding spoilage of perishables.

Baggage tracking, handling and transferring at local and international airports require systems sufficiently scalable and adaptable to accommodate several airlines and high growth in travellers and airfreight. Hardware and software based automated solutions are increasingly used to meet these requirements.

Courier package collection and delivery companies have been early adopters of mobile computing devices to confirm deliveries at the location and time of delivery. High-performance package routing systems in staging warehouses have now become essential elements of providing worldwide accurate tracking and delivery services.

Supply chain management has become increasingly important in business over a period of some twenty five years and computerized systems have become indispensable in inventory control, procurement, manufacturing, distribution and retailing of goods. Robots are now at the beck and call of human operators, moving easily through vast warehouse shelves and stacked palettes gathering and bringing what's needed in manufacturing or despatching.

Deep, shallow and open-pit mines feed world economies with fossil fuel resources to generate energy, and also provide metals and minerals for industry to convert into products of many kinds. In these endeavours management is focused on improving yields, reducing costs and

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increasing safety. However, automation of mining operations generally has evolved rather slowly, mainly as a consequence of the harshness of mining environments and safety concerns. One of the most impressive trends has been "longwall mining" of coal, a technique dating from the late 17th century in England. This is where a long wall of coal is mined in a single slice from a seam or block of coal typically 1–2 meters thick, 250–400 m wide and as much as 3–4 km in extent. The coal is cut from the wide coalface "longwall" by a shearing machine that moves along the coalface tearing the coal from the face with rotating cutters. As mining progresses through the seam, the mined-out section collapses by a few meters under the weight of the overlying earth. Hydraulic jacks support the roof ("hanging wall") of the coalface and the array of jacks advances about one meter at a time as the mined-out earth collapses behind them.

Somewhat in contrast to physical mining, during the past twenty five years automation in minerals processing, cost accounting and asset maintenance and management using computer control and optimization techniques has greatly reduced costs and increased productivity. Attention now is turning increasingly to meeting the need for automating mining itself, particularly in hazardous, difficult to reach situations and remote locations that could compromise miner safety and/or be costly to staff with professionals.

CURRENT SERVICES ENHANCEMENT

There are many types of advanced technology-based services to which we have become accustomed during the past ten years. We use the Internet to book travel, buy goods, invest funds, bank and pay accounts, play games and view multimedia content. We email and use social networking applications to keep up with the activities of friends and colleagues. Skype and similar services webcam our faces across the world. We enjoy TV and use fixed and mobile telephones to communicate verbally.

In the workplace and home our communications and computing devices connect using Ethernet and WiFi local area networks (LANs) enabling the easy sharing of information databases. In our daily adventures we participate and cooperate with colleagues and friends through location-aware smartphones and tablets, using Internet and Cloud resources accessed by high-performance 3G, 4G LTE and WiFi wireless networks. Multimedia theatre, music and movies and engaging advertising are increasingly offered to us on portable tablets, smartphones and ultrabooks, anywhere, anytime.

We participate with colleagues, clients and friends at physical meeting places that provide business, computing, restaurant and sporting services that are integrated into the world wide web (WWW) of knowledge.

Packages are delivered to us by couriers and postal services. Airlines fly us to delightful resorts. Blister packs of medications come to us from pharmaceutical factory and pharmacy services. Healthcare services treat illnesses and casualties and assist in overcoming human disabilities. Police, paramedics and fire-fighter services attend to emergencies. Defence force services protect our countries. All of these services are reliant on high-tech electronic and mechanical devices and systems.

In financial services, computer systems automatically buy and sell equities, bonds and other investment instruments based on threshold prices set by clients and brokers. These trading methods have modified the way in which stock and bond markets prices react to economic and financial news.

Computers have largely taken over routine tax and business accounting calculations, enabling financial services firms to focus their professional workers' skilled minds more extensively on business strategies, forensics, risk and security, and compliance to regulations and their interpretations.

In computer security, anti-virus, anti-phishing countermeasures have achieved a significant degree of automation. Additional effort is now being expended on countering versatile spam generators (bots), malware, network penetration, identity theft, whaling and many hostile difficult-to-detect network probes. Security advisory services, company C-suites and boards are increasingly turning their minds to comprehensive countermeasures for cyber crime.

While Internet Protocol (IP) - based services are routinely provided by interconnected hardware and software technologies, it is only recently that focus has intensified on the "Internet of Things", terminology first coined by Kevin Ashton over a decade ago. This refers to, adaptive, intelligent interconnections of, and communications between, sensors, machines, devices, objects, systems and software, entirely without human assistance. Known also as machine to machine (M2M) communication it's an important part of emerging intelligent automation, more of which is revealed in later sections of this paper.

In genetics and pharmacology new molecules are being developed with sufficient "intelligence" to locate and home-in on specifically diseased cells.

There has been a sea change in the way executives, employees and customers manage their lives using technology. Driving and being driven by technology, they engage easily with the internet, search engines, multimedia, social networking and collaboration, mobile communications and cloud computing - all of which increase their ability to participate effectively and ubiquitously. Indeed, "Ubiquitous Participation (UP)", a term coined by PwC, has now become a way of life in contemporary society and business for people leading demanding high-speed lives, working and playing across geographical and time boundaries.

More recently, PwC coined a single word to describe these savvy consumers and workers: they are "Selfsumers". The selfsumer is entirely comfortable with a variety of technologies and is skilled in using them. Highly discerning, selfsumers want to see useful results and acquire knowledge quickly and easily at leisure and at work. They are keen to engage and make an impact and are eager to enhance their business and personal skills and learn new ways of working productively and enjoying free time. They interact enthusiastically with advanced machines, provided that it's easy to do so. In a very real sense, the "killer app" of this era is "ease of use".

To provide selfsumers with innovative applications and cross link them with a variety of interesting experiences, machine to machine (M2M) interaction must now move beyond mere communication to M2M collaboration and M2M social networking. This will partly be driven by technology and partly by selfsumers themselves who, in this age of rapid changes and mobility, want comprehensive insights and facts delivered automatically to their mobile devices. Selfsumers do not have the time or inclination to perform in-depth searches across huge databases in disparate locations or sift through conventional search-engine myriad suggestions. Automatic systems and services are needed that discover, consolidate, assemble and present comprehensive information to selfsumers enabling them to make circumspect decisions quickly and effectively in business and at leisure, while on-the-go.

Autonomous physical and virtual robots, once in the realm of science fiction are emerging as powerful assistants to humans, providing a range of enhanced and new services. This trend will continue and accelerate in the years ahead.

In genetics and pharmacology new molecules are being developed with sufficient "intelligence" to locate and home-in on specifically diseased cells. New ways are evolving of distributing medications automatically to hospitals and clinics and direct to patients.

The Web is changing from a relatively straightforward IP-network of interconnected computers to one in which machines interact and participate cooperatively and intelligently, providing not only improved services but also entirely new ones. The "Participative Web" is emerging.

These and related new services concepts and their applications are explored further below.

MOBILE, CLOUD AND DISCOVERY

Mobility enables selfsumers to interact with, and contribute to, information, knowledge and business and entertainment content anywhere, anytime. Beginning as mobile voice communication in the early 1990s, mobilility evolved rapidly into high-speed cellular and WiFi networks connecting versatile smartphones. These devices are able to search the Internet and allow emailing, text messaging (SMS), instant messaging (IM), photography, location-based applications and video conferencing. Portable tablets and laptops provide larger displays and touch screens and/or QWERTY keypads further enhancing user experiences.

Smartphones rarely leave our hands, going with us wherever we go. In a very real sense, they are "intimate devices" without which we cannot function at our best, in business or at leisure. Global positioning satellites (GPS) and cellular base stations engage continuously with smartphones automatically informing them of our location. This service is provided by M2M communication, in other words by automatic systems communicating without human assistance. We can think of this as a distributed location-determining robotic service to holders of smartphones. But this service is merely a beginning. Location allows relevant contextual information to be found automatically on the Internet, intelligently packaged and conveyed to us in easy-to-absorb forms.

For instance, the specific locations of nearby restaurants serving food of our liking can appear on our smartphone without searching for this information. Merely recognizing that the time of day is our preferred snack, lunch or dinner time is sufficient for this service to be provided automatically by intelligent software robots "anticipating" our needs. There is a growing

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recognition of a natural symbiosis between mobile services and the cloud of content resources that will lead to many new mobile "Anticipatory Discovery" applications. What is happening is that search, which has been largely based on keywords inputted by users, is evolving into a more automated, context-aware discovery mode. Computers are beginning to anticipate in-the-moment business and recreational needs and assemble solutions automatically for the selfsumer.

In the enterprise we can look forward to the implementation of location, client- and time-based services that provide automated decision support to executives and staff enhancing productivity, particularly of mobile workers. Intelligent software robots could autonomously become aware of the location, the time and the information needs of a forthcoming client meeting. Then the mobile worker would be supplied automatically with a comprehensive dashboard display on his/her mobile device consisting of information on the client, the results of previous meetings, the deliverables for the current meeting and dining and entertainment possibilities in the neighbourhood conforming to client tastes and the time of day.

Machine collaboration with workers is likely to be important in effecting improved worker productivity. Automatic recognition by M2M intelligence that several workers are engaged in closely related activities will enable immediate provision of relevant information and knowledge to all the team members, thereby avoiding costly time-consuming, duplicative individual search efforts.

PwC Canada has demonstrated client-oriented dashboards on tablet computers including the PlayBook™ and iPad™, in an innovative step towards anticipatory discovery, serving mobile selfsumer knowledge workers. Providing technology advisory services to clients on how to provide in-the-moment, comprehensive information to their employees is a consulting offering likely to grow substantially during the next few years.

A related trend in advertising, entertainment and leisure is that of automatically providing personalized bouquets of video and audio content, anytime, anywhere on any end-user device, emancipating viewing from the constraints of living-room, office, country, canned programmes and set viewing times.

Many industries are actively seeking to improve the efficiency and reliability of their operations and are looking to intelligent automation in upgrading their industrial and business processes. Relying purely on human controls and interventions is rapidly becoming a thing of the past – operations have become too complex to rely on this, and the consequences too dire to risk. Specific, high-profile industries moving toward intelligent automation include oil and gas, manufacturing, pharmaceutical and chemical, food and beverage, water and wastewater and electric power generation and grid management.

With the rise of high-reliability wireless, mobile services and end-user devices, it is being appreciated that wireless systems can save conventional costs; for instance, those associated with laying cables and obtaining permits for easements and rights-of-way. Using wireless networks, upgrades to process control parameters and software are also made easier. In geographically distributed enterprises, wireless intelligent supervisory control and data acquisition (SCADA) can connect field sensors and haulage-vehicle position and work-status directly into the enterprise's financial, supply chain, invoicing and management systems enabling near realtime business decisions, some of which can be taken automatically. This trend, already begun, will increase during the next few years.

CYBER SECURITY AND NETWORK OPTIMIZATION

In implementing security and privacy policies and strategies to counter cyber crime and the compromising of personal data, cooperation between the C-suite and enterprise workers is essential. On one hand selfsumers increasingly require, or even demand, that multiple desktop, portable and mobile devices be made available to them for use at work and whilst at leisure.

This can open up new vulnerabilities to cyber criminals' many favourite mechanisms of attack including malware and network probing to steal or alter confidential business information, and worker and client identities. For example, it is now known that some downloadable mobile apps can scoop up and send mobile address books to the originators of the apps or to clandestine databases for commercial or nefarious purposes, without the mobile user's knowledge or permission.

On the other hand, being responsible to their employers through codes of conduct and personal integrity, selfsumers accept that there is a need for continuous alertness and defences to counter commercial espionage and malevolent intrusion and that this requires un-interrupted automation of security services, 24/7.

With the rise of high-reliability wireless, mobile services and end-user devices, it is being appreciated that wireless systems can save conventional costs...

Real-time automated monitoring, simulation and analysis techniques are now quite widely used to produce in-the-moment business intelligence and analysis allowing C-suites quickly and incisively to adapt and enhance business strategies and tactics. As cyber crime is becoming increasingly prevalent and alarming, it is now necessary to implement similar automated intelligence gathering and analytics systems specifically focused on cyber-crime prevention, to discover and remedy breach attempts and automatically update C-suite security strategies and tactics based upon the experience gained.

A relaxed approach to cyber security just will not do: contextually driven automatic decision-making will have to replace mere reporting of breach incidents to the responsible executives. This is particularly important in cloud-based services that operate in their own world of security, backup and disaster recovery, usually remote from the end-user enterprise which may be unaware that its information in the cloud is coming under attack. Assurances to clients that cloud-based services are secure can only be convincing if it is demonstrated that threats to their cloud data and its processing are nipped in the bud and not allowed to propagate and grow "behind cloud doors". Contextual in-the-moment, intelligent methods are being developed especially for this purpose.

The new technology of homomorphic encryption being developed by several organizations including Microsoft Research, IBM and MIT enables operations to be performed on encrypted information without decrypting it. Current homomorphic algorithms are not yet suitable for implementation, but progress is being made, and when practical algorithms emerge from R&D, homomorphic encryption will play an important role in the security of cloud-based storage and query services. This will likely settle once and for all the concerns of cloud users about the security and privacy of their sensitive information. In the meantime it would be appropriate to keep data in encrypted form in the cloud, decrypting only those subsets of data required to answer current queries and then destroying the decrypted data as soon as it has been used. In that way, the amount and time duration of decrypted information would be limited, thereby reducing the risk of its falling into unauthorized hands.

Network management and optimization is a problem of growing importance and difficulty especially in organizations which span many countries having their own confidentiality, privacy and compliance legislation. The problem is exacerbated if they have acquired companies with disparate computing and communications systems and firewalls. Only rationally designed communications and computing architectures and their careful implementation and continuing updating as circumstances change will reduce risk of malfunction and information loss. Intelligent software robots will be required that automatically monitor and track changes, for instance in government regulations, firewall protocols and security updates, and then adjust the network configuration and parameters to achieve better network control and optimization. Such algorithms will have to identify and perform root cause analysis automatically to correct malfunctions and anticipate or recover from network invasions and incompatibilities before they do damage to the organization.

Whenever new ways emerge of accessing financial resources or making investments and payments, there is anxiety about safety and security. So it was when online banking was introduced. But it became apparent that using sufficiently strong secure socket layer (SSL) codes, online transfers and payments were much safer than paper-based methods.

This is likely to be the case with the introduction of mobile "touch-to-buy" electronic wallets embedded in smartphones along with near field communication (NFC) to wirelessly effect transfer of wallet funds at points of sale. Such semi-automated funds access and payment technologies will likely improve security, immediacy and accuracy of transactions.

COLLABORATIVE BUYING

In the consumer sector shoppers seeking shoes, a dress, sunscreen lotion or services, have become adept at using online social-networking group-shopping apps that provide access to deeply discounted products or services provided that a certain number of purchases are made on the same day and/or at the same time by a group of buyers.

Offline group/collaborative buying has quite a long history of use in some sectors of industry to reduce input costs. Even companies with competing brands have found that cooperating and pooling their purchasing of staple materials and consumables has the advantage of reducing company costs without losing brand differentiation. The primary reason for this is that input materials often are commodities unseen by consumers of the branded end products.

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Robots can autonomously disinfect hospital rooms and surfaces perhaps more thoroughly and effectively than can human workers are emerging and could become widespread.

As secure online group purchasing becomes more automatic using M2M communication and collaboration, finding the best deals and then placing group orders in accordance with inventory requirements of each group member will likely take place with no or little human intervention. Human company buyers will be freed from routine purchasing and be able to concentrate on cost-effective purchasing of brand-specific items exclusive to their companies' needs.

HEALTHCARE AND MEDICINES

Automated M2M intelligence in medical services will become widespread especially as populations increase in age and large numbers of seniors require quicker, effective medical monitoring and interventions. Intelligent software agents will automatically present doctors with decision support services that provide them with treatment, medication and rehabilitation options and their known effectiveness and unwanted side effects. Furthermore, by coordinating the presentation to doctors of blood test and scan results through M2M collaboration, without the doctors having to search or request information from several different clinical sources, diagnosis, treatment and follow-up will be enhanced significantly.

Intelligent automation is not limited to macro-scale processes. Pharmacogenomics, the study of how micro-variations in human genes affect response to medications will permit safer, more effective medications to be tailor-made or designed, so-called designer drugs, for each patient's genetic makeup. The emergence of such intelligent drugs has begun, primarily in the high risk/reward field of cancer. Here, nanotechnologies are already being used as cradles or shells to convey toxic drugs only to cancerous cells, not damaging healthy tissue. In a similar vein, intelligent molecules are emerging that find and wrap around harmful DNA helix structures, effectively smothering their devastating effects. Furthermore, tracking and image processing techniques are emerging that follow their path, thereby alerting physicians to specific locations of diseased cells and their patterns of spread.
Ubiquity of mobile wireless devices and availability of sensitive low-power-consuming sensors is making it possible to automatically monitor the health of patients, presenting real-time, intelligently summarized, ambulatory data in easy-to-absorb formats to healthcare professionals. As electronic health records (EHR) gains traction worldwide, remotely measured patient data will be integrated automatically into central patient record databases and the physician's patient-follow-up displays.

Unlike conventional industrial robots, newly emerging service robots do not have to be fixed to work tables or stations. They are intelligent and have electronic eyes, ears and balance mechanisms and can move. Are practical service robots available and effective and will or should they replace humans? The positive answer is that there have been dramatic advances in robotics during the past five years. This is leading to entirely autonomous robotic servants that find their way around using inbuilt 3D-vision, touch, hearing, taste and smell sensors, mapping their environment adaptively to avoid obstacles and reach intended destinations. The Fraunhofer Institute's multi-legged robots ("Fraunhofer Spider") could prove to be exceptionally good at manoeuvring through dangerous or highly convoluted terrain. But autonomous robots that replace and outperform humans, for instance in hazardous situations, are not all there is likely to be. Already well known, the surgical robot da Vinci ® enhances the skills and effectiveness of surgeons in minimally invasive surgery. This robot is driven by a surgeon seated at a console equipped with graphical interface and manipulator handles. The robot itself provides 3D high-definition vision with EndoWrist® instruments allowing additional surgical dexterity, precision and control, beyond what is possible with human arms and fingers alone. The brain of this robot is the surgeon's.

Robots such as Xenex™ that can autonomously disinfect hospital rooms and surfaces perhaps more thoroughly and effectively than can human workers are emerging and could become widespread.
With the introduction of Kinect, an object and motion sensing "gesture control" device from Microsoft developed first for computer games, gesture control of software and hardware systems is becoming increasingly effective. For instance, during surgical procedures at Sunnybrook Hospital, Toronto, Kinect is being used by surgeons to page through x-ray and scan records using gestures rather than touch, decreasing the risk of contamination from physical surfaces and eliminating misunderstanding that could arise if intermediary assistants were requested to perform this function.

Rehabilitation services will have to expand, responding to new needs of aging populations, accident victims and returning war veterans – and their high, though reasonable, demands and expectations for more effective therapies. Intelligent gesture control systems seem to have a natural role to play in integrating physical games, exercise and therapeutic movements with 3-D visual and physical routines.

From the time that Gordon Moore first enunciated his still famous Law that the number of transistors in integrated circuits doubles approximately every two years, semiconductor chip manufacturing has spawned and relied upon a variety of adept machines for handling delicate wafers, doping them with rare-earth chemicals, testing, inspecting, dicing and packaging the chips for use in electronic products. These types of automatic machines driven by combinations of hardware and software are not restricted to semiconductor manufacture. The emergence of increasingly accurate, sensitive, miniature biological and engineering sensors is enabling these manufacturing technologies to become very widely applied in industry, including in pharmaceuticals dispensing services. This trend is likely to revolutionize how doctors prescribe medications in electronic form and the dispensing and delivery of pharmaceutical drugs and treatment kits automatically to hospitals, inpatients and ambulatory patients.

MINING, TUNNELING AND QUARRYING

Not surprisingly in the light of its immense mining history, South Africa has led the world in developing electronic detonators in mining. Electronic technologies allow significant blast improvement through precision timing, pre-blast fault detection and correction, as well as improved safety and security. Electronic detonators have inbuilt safety features that conventional pyrotechnical devices lack, reducing risk of accidental or unauthorized initiation; for instance, access of mining personnel to electronic blast initiation devices is controlled by requiring encrypted blasting codes. Electronic detonators typically are initiated at a distance from blasting sites, sometimes from faraway locations, providing safer, high-precision, sequentially-timed blasts. This results in improved rock fragmentation, controlled "muckpile" throw and, consequently, reduced mining costs. In recent years electronic blasting technologies have evolved to withstand high and low environmental temperatures and humidity conditions allowing them to be used in extreme mining conditions. We foresee an increasing use of electronic detonation systems in mining and generally in excavation as automation increases to gain acceptance in the industry.

With the success of the da Vinci ® robot in surgery, and manipulators in nuclear engineering, we foresee development and application of advanced actuator systems entering mining. Precise action and control at-a-distance are highly attractive attributes in mining, where mistakes can cause consequential falling-rock damage and injury.

No longer are robots confined to immobile workstations doing repetitive, fully programmed tasks such as welding of automobile pieces and picking and placing components onto circuit boards. Now robots are emancipated – they can move their position, automatically navigate around obstacles, balance and run as bipeds and pursue and catch moving objects. Honda's humanoid ASIMO autonomously runs, negotiates steps, hops on one foot and balances, apparently as well as a human. Robots that autonomously fold previously unseen towels and catch balls thrown in unanticipated directions are indicative of robotic versatility and intelligence that lie ahead. What is causing this eruption of progress in robotics? Evidently, high performance tactile, position, attitude and visual sensors coupled with powerful computing "distributed brains" in the robot and cloud.

Robots are becoming self-determined in their movements and actions in unanticipated environments in which they find themselves, manoeuvring around obstacles and grasping the right tools and materials to do their work. The time seems ripe for intelligent robots to enter mines and provide enhanced mining services, even at the rock face as part of lean and agile mining effecting process improvement and enhancing efficiency. We will likely see intelligent robots increasingly implemented below and above ground integrating mining operations with information management systems, minerals processing, warehousing, procurement and transportation. Already robotic haulage trucks are being introduced in remote mines in Australia allowing their human supervisors to work in distant metropolitan centres from which several remote mining operations can be planned, scheduled and managed using ingenious graphical user interfaces (GUIs).

DEFENCE

Unmanned aerial vehicles (UAVs) have achieved recent fame in distant wars, adding to conventional military reconnaissance capabilities and fire power and reducing the risk of airborne and ground-troop casualties. Development of next generation UAVs focuses on larger devices having intercontinental range, carrying heavy payloads and taking off and landing on aircraft carriers. But this is not all there is to UAVs. Automatic

Enhancing Services with Intelligent Automation

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communication and networking between UAVs is enabling realtime surveillance over wide geographical areas and squadron-type coordinated attack capabilities, likely evolving into autonomous decision making without the need for human involvement other than to monitor and intervene in particularly sensitive, complex circumstances. Similarly, ground-based remotely-controlled machines are already being used in landmine discovery and defusing. Heavy load carrying four-legged robotic mules for ground-based troop support are in advanced stages of development, "BigDog" from Boston Dynamics being the most famous. The fast-paced "Cheetah" prototype from the same company recently appeared on the quadruped robot scene.

Robots connected to the Internet and cloud services are beginning to emerge. This is allowing robots to be immensely knowledgeable and also enable them to download application software specific to the task at hand. Being connected wirelessly or by wireline to the cloud will allow "distributed robot brains" leading to robot teamwork. Cloud robotics won't be confined to military applications. Assistive robots in healthcare would be an example of where else they will find a home.

RETAIL AND REAL ESTATE

RFID tags have a long history of use in retail as security tags that sound the alarm if they have not been deactivated prior to goods passing through store-exit sensors. In the near future they will have other more constructive uses that aid shoppers and shop assistants to initiate and complete purchases. Assistants will be able to scan stock automatically, based on descriptions of what articles a customer would like to see and try on or try out. No longer will it be necessary to wade through racks of articles searching only by eye and hand – often missing an article that could appeal to the customer. Shoppers themselves will be able to discover interesting articles using in-store and in-dressing-room graphical user interfaces (GUIs) and, most important, locate them electronically in specific places on shelves or hanging in racks. Rudimentary implementations are already available in some bookstores to improve in-store browsing. Location-specific coupons, special offers and up-to-the-minute information are now being provided on mobile devices of shoppers in malls if they have "opted-in" for this service. With the introduction of Near Field Communication (NFC) and Bluetooth payment apps on smartphones, these trends in automated shopping services are set to grow markedly.

Real estate development, sales and services require up-to-date high-quality maps and images of residential and commercial areas. Aerial photography from manned aircraft has been an expensive and limited way of obtaining such geographical information. High-resolution satellite imagery has been useful in augmenting aerial photography by providing backgrounds to large areas under development. As the level of sophistication reached by military UAVs allows the capture of high-resolution photographs and also real-time video, versatile drones based on military technologies are now beginning to be used in real estate image capture and environmental monitoring. Initially objections were raised by law-enforcement authorities that federal aviation regulations were being violated, but now the use of drones is being allowed more liberally in the US by recently enacted federal legislation. Applications currently are emerging in real estate, crop spraying, fauna and flora monitoring and movie shooting.

CONCLUSION

Intelligent automation is likely to develop strongly in the next two to five years and become established in enhancing services in disparate fields of human activity. Adequate disaster avoidance and recovery procedures will need to be designed-in to counter situations that could perhaps arise where automation, albeit intelligent, may malfunction or be otherwise "overcome" by unforeseen circumstances, autopilot limitations in commercial aircraft being a case in point. PwC's technology-systems architects and advisory services will work with clients to assist in their adopting intelligent automation and associated safeguards, including when and how expert human operators should intervene to avoid or circumvent services disruptions and mitigate risk. wn

Earn CPD Credits

MV Distribution line protection utilising specialised surge arrestors

BY | MR. PHILIP RISI **|** CEO **|** LIVE LINE TECHNOLOGY

Live Line Technology are surge arrestor products manufactured for medium voltage networks ranging from 3kv to 33kv, with 11kv and 22kv being the more ubiquitous. The market extends across the South African market, SADC countries and African developing countries who possess large rural networks.

Often developing countries struggle with the management of longer overhead lines, creating difficulties in the effective management and maintenance of their distribution surge arrestors. Live Line Technology is a solution to the effective replacement of distribution surge arrestors where the technology drives the operator rather than the other way round.

The Live Line surge arrestor is rated at 10ka 8/20µs is popular amoungst production facilities who cannot afford downtimes with reference to surge arrestor maintenance, Eskom who owns the largest network of medium voltage overhead lines and most African Utilites. South American companies such as those in Columbia and utilities in the USA are also utilizing these units in their larger rural areas.

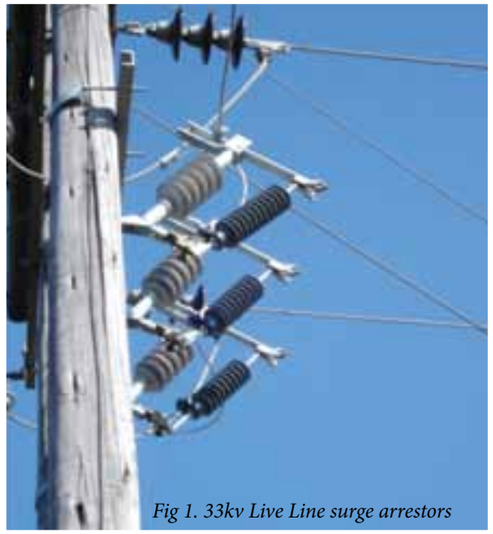

Fig 1. 33kv Live Line surge arrestors

The Live Line surge arrestor is rated at 10ka 8/20µs is popular amoungst production facilities who cannot afford downtimes ...

MV Distribution line protection utilising specialised surge arrestors

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Benefits of the Live Line arrestor (Firewall) include, replacement from ground, via a telescopic link stick. The units drop-out when expended and provide easy replacement. No outages are required when deploying these units.

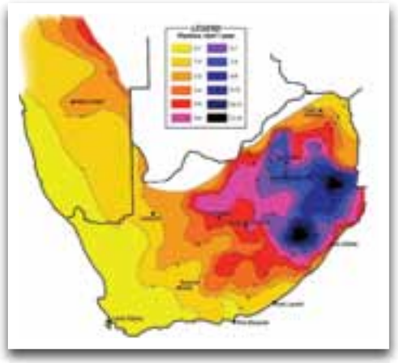

Fig 2 - Typical lightning density map of South Africa and Namibia.

South Africa experiences some of the most intense lightning activity in the world. Thunderstorms that are prevalent during summer may only last short periods of time but unleash very powerful electrical discharges or lightning strikes. The Highveld and Northern Kwa-Zulu Natal regions are areas that have the greatest lightning densities. Lightning density is measured on a scale in South Africa as the number of flashes to ground per square kilometer and is scaled from 1km²-14km². This high lightning activity leads to surge arrestor failure, rendering the unit ineffective and needing effective and timely replacement.

SHORTCOMINGS OF TRADITIONAL DISTRIBUTION CLASS SURGE ARRESTORS.

1. No electrical warning once the surge arrestor fails.

Distribution surge arrestors in South Africa are rated at 10ka with a time curve of 8/20µs. They have a GLD (ground lead disconnector) which needs to operate within the SEF (sensitive earth fault) time curve of 3A / 5 seconds on Eskom distribution networks as to prevent the substation from tripping. Distribution surge arrestors can operate for years without failure, but are expendable as they draw the lightning energy through themselves keeping the voltage potential between the phase and earth at the same differential, saving the equipment they are connected to.

Notwithstanding, once these units have come to the end of their lifespan they simply blow an earth lead located at the bottom of the surge arrestor to prevent the failed unit from discharging leakage currents to earth causing SEF (Sensitive earth faults). No electrical warning is provided, only a visual indication that the ground tail has operated. The unit then needs replacement as soon as possible before the next surge or lightning transient flows through the overhead line into expensive equipment and damaging the apparatus it was designed to protect.

2. Multiple Unprotected transformers

Linesman need to ensure that pole-mounted transformers are protected with a healthy distribution surge arrestor on each phase at all times. This is achieved by effectively replacing these units , providing the necessary surge and lightning protection to equipment that costs 100-200 times more than the surge arrestor unit itself. Unfortunately, line custodians often operate lengthy sections of rural networks and cannot

Fig.3 10kv Surge arrestor and GLD (Ground lead disconnector)

get to remote locations in time to save the transformer from surges or lightning storms, which damage the surge arrestors over time. Transformer failures increase substantially during the rainy season of October – April each year. South Africa's pole-mounted transformer failure rate is higher than the average utility supplier around the world, with transformers often not reaching their full 20 year lifespan.

3. GLD (Ground lead disconnectors) that do not operate correctly

It may occur in some cases that traditional distribution surge arrestors come to the end of their lifespan but do not correctly disconnect from the network.

If a GLD (ground lead disconnector) is graded above the time curve of 3A/5s, the surge arrestor will expend itself overtime but will never disconnect from

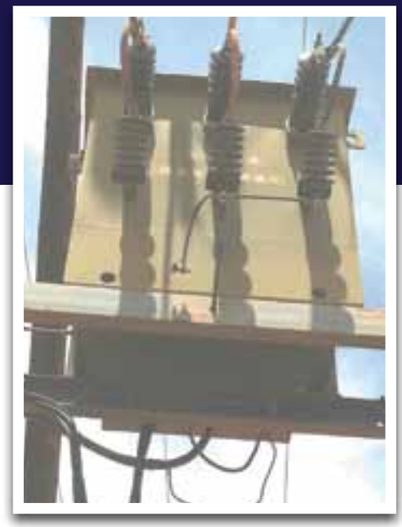

Fig.4 A spent 11kv surge arrestor, that has blown its GLD with no replacement installed. Research reveals this shortcoming is a major contributor to transformer failure rates within Southern Africa, as surge arrestors are not replaced for lengthy periods of time.

the network. A linesman will then need to try and identify the spent unit, which is almost impossible to find. The unit will create a SEF (sensitive earth fault) and may trip the substation, until it is recovered, removed and replaced with a new unit. This creates a situation of a sustained outage until the problem is identified and rectified, negatively affecting SAIDI ans SAIFI's.

The opposite can also hold true, where a GLD (ground lead disconnector) may prematurely operate and leave the unit ineffective, whilst it remains intact. This will create a situation where multiple surge arrestors across the network will start failing and the linesman will have to replace all those units to restore the protection.

INCORRECTLY CONNECTING A SURGE ARRESTOR

A surge arrestor needs to be connected between two points, namely the phase

Fig.5 GLD operating prematurely creates a difficult scenario for the linesman

and the earth point. It is also important to remember that a surge arrestor does not divert the surge or lightning strike but discharges the surge or lightning by allowing it to travel through itself.

When connecting the surge arrestor the linesman needs to connect the surge arrestor close to the unit it is protecting, but not at the cost of incorrectly connecting the surge arrestor. It is important to never connect the surge arrestor through a fuse. A fuse is not designed to discharge lightning and will blow once the surge arrestor starts conducting the lightning transient energy. This will render the surge arrestor useless under the given time frames, as a surge arrestor needs to conduct between two points namely phase and earth. This also creates an imbalance on the three phase system and creates a potential voltage differential between phase and earth, degrading the insulation co-ordination overtime and damaging the equipment it was designed to protect. See fig 6.

A surge arrestor incorrectly connected has to work through a "weak link" being the MV Fuse. The surge arrestor needs to be connected between two points to be effective. When the lightning surge blows the fuse, the surge arrestor is hindered

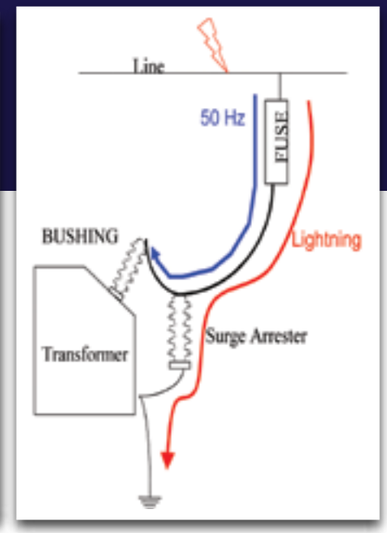

Fig 6. Incorrect placement of the surge arrestor at the pole-mounted transformer.

and deemed ineffective during the time duration of the strike.

Source : Willem Dirkse van Scalkwyk (M. Thesis) "The placement of line surge arrestors and fuses on 11kv abd 22kv lines to protect against lightning.

Theft of earth leads

A surge arrestor needs to operate between the phase and earth point. If thieves steal the earth conductor, it renders the surge arrestor ineffective, as the lightning transient cannot be discharges into earth.

Good earths imperative

A high resistant soil will hinder the surge arrestor to effectively operate. The standards indicate that the earthing of a surge arrestor should be less than ≤ 20 ohms.

CONCLUSION

The surge arrestor in the Firewall can significantly improve the insulation co-ordination of the MV distribution network without the sacrifice of a planned outage later on once the unit is expended.

The surge arrestor in the Combi unit, which is Eskom specification D-DT-1877, houses both a live line surge arrestor and

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Fig. 7 Lightning damage to a overhead pole, due to theft of bonding cables to the earth point.

Fig.8 The live line surge arrestor in the Combi unit is positioned not further than 1 meter from the transformer, Eskom specification, D-DT-1877.

fuse link in a parallel connection, allowing the surge or lightning to travel through the surge arrestor and not the fuse. The voltage potential between phase and earth remains at the same differential, providing the protection to the transformer and equipment it has been designed to protect.

The surge arrestor protects both the fuse and transformer, reducing transformer failure rates.

The surge arrestor is replaceable from ground via a telescopic link stick, reducing the time of surge arrestor replacement from 30min- 1 hour to a 3 min operation.

Linesman can carry out their replacement of the surge arrestor more effectively because they are electrically alerted once the unit expires.

BENEFITS OF LIVE LINE SURGE ARRESTORS IN THE TRANSFORMER COMBI UNIT:

- A healthy surge arrestor is present at all times. It provides a electrical and visual indication once it is spent.
- Both Fuse and Arrestor can be changed from the ground.
- Replacement of the surge arrestor is done via a telescopic/hot stick.
- Unplanned Outages are eliminated. There are no more nuisance blown fuses as the fuse is outside the lighting path.
- Planned Outages enforced. The surge arrestor is prioritized. The technology drives the linesman and needs to be in position for the unit to operate.
- The surge arrestor protects the Transformer & Fuse. Other configurations create a scenario of multiple transformer failures and fuse blows.
- The surge arrestor can be changed. wn

REFERENCES

- Web - www.liveline.co.za
- Electrical engineering masters thesis - Willem van Scalkwyk, of Eskom. (October 2000)
- Eskom's unique type test requirements for Lightning Surge Arrester Ground Lead Disconnectors, R Theron & H. Geldenhuys (October 2007)

Linesman can carry out the replacement of the surge arrestor more effectively because they are electrically alerted once the unit expires.

Living with an Engineer

From the non-engineering wife's perspective

I am not an engineer, but I have married one of these intriguing creatures and therefore believe that I am something of an expert on the topic and well qualified in my own right.

BY I ANGELA PRICE

I began my qualification by doing years of apprenticeship with the same tutor - my father. A Mechanical Engineer by profession, he has a passion for steam trains, taking things apart and taking over the garage! These years provided me with some unique insight (which I should possibly have paid more attention to).

I then furthered my qualifications by dating (and consequently marrying) an Electrical Engineer…not just any engineer mind you. Almost unknowingly, I had married the great- grandson of Dr. Bernard Price (the father of electricity supply in SA), thereby firmly entrenching myself in a well-established engineering family and consequently elevating my studies to a PhD status!

Growing up with an engineer as a father, has 2 (almost) guaranteed outcomes (take note parents):

1. you will become an engineer, or
2. you will marry an engineer.

Engineers are smart (so I am led to believe). If I were smarter I may have been an engineer, to my father's delight, but I am useless at maths (I still add up on my fingers… under the table). So I defaulted to option 2 and married an engineer. I believe engineers are like my Blackberry… hard to figure out but you get used to having them around and then you find that you can't live without them (quite possibly by that stage you have been suckered into a lifelong contract)... I was hoping for the promised 2-yearly upgrade but am still waiting!

I learnt several important lessons during my apprenticeship with my father, some positive and some negative.

POSITIVE: ENGINEERS CAN FIX THINGS NEGATIVE 1: THEY HAVE TO TAKE THINGS APART IN ORDER TO FIX IT.

This first (and possibly most important) point is arguably the greatest selling point when it comes to marrying an engineer. Indeed, it is what makes it almost impossible to live without an engineer once you have got used to having one around.

Engineers LOVE to fix things, a wonderful attribute that saves money. This is a great marriage incentive, after all it frees up cash for shopping trips – always a positive with any woman. This handy quality truly comes into its own when you are building your nest, even more so when you add kids to the mix as they seem hell-bent on destroying your nest, piece-by- piece.

As a designer I love to dream and design. I am not so good however, with the practical implementation and this is where my husband shines. Sure, it nearly wrecked our marriage after the first week when we had a MAJOR argument involving: a mirror, a level, a tall, practical engineer and a shorter designer with some possibly-not-so-practical design ideas (personally I blame the design magazines).

For the record... the designer won (we females have secret negotiating tools).

For every "Up" there is a "Down", and the down side to their ability to fix just about anything is that engineers have to take said item apart in order to fix it (sometimes even several of the same item…my father-in-law has 5 old irons in pieces in his garage!). During my apprenticeship years with my engineering father this point was brought home to me in 2 unforgettable examples.

The 1st involved my mom's old, aubergine-coloured Volvo. The words 'luxury' and 'Volvo' simply did not go together in this

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Engineers are so practical, which has the negative side effect of killing romance – stone dead.

instance, this was a skidonk (granted it was solid and we would not have died if we had been in a crash- a fact my father often reminded us of). In the mind of a 10yr old this was definitely not a cool car! However, little did we know, things were about to get a whole lot un-cooler.

The reverse gear on the car stopped working which resulted in us children having to do the seriously un-cool job of pushing mom's car backwards on the occasions when we forgot to park on a slope.

But not to worry, my dad just so happened (as engineers do) to have an old, gemsquash-coloured Volvo stashed away at the bottom of the driveway for one such an eventuality! My father was adamant that he could strip it and use it to fix up the aubergine Volvo; we were not going to go to a car mechanic, perish the thought!

Opinions differ as to which party mutinied first; whether it was mom, who got tired of the inconvenience of a car with no reverse gear and a driveway resembling that of the local scrap yard - or if it was the children, who finally rebelled against the child labour and resulting un-cool status (let's be honest, there is nothing quite so totally un-cool as having to push a car backwards – with your friends in it!)

NEGATIVE 2: IN NO HURRY

Taking things apart to fix them may seem obvious - even to a non-engineer like me - but then you have to remember the other little problem...engineers seem to be in no hurry at all to put them back together again. Need your Kenwood mixer fixed?

No problem. Just remember to factor in:

- the number of trips to and from Builders Warehouse,
- the tools,
- planning time ……
- and the fact that quite possibly your Kenwood may never re-emerge from the garage.

5 years later however, you could possibly have a better-than-new-super-speedy (but dusty) Kenwood back in your kitchen. Alternatively you could have just bought a new one, saving time and possibly even money in the long term – but alienating your engineer in the process.

This brings me to my 2nd example which is a fishy one…literally! The year was 1998 and we had a nicely functioning fish pond right outside our front door until someone or something decided to remove our fish…picking them off slowly one-by-one. This was in days gone by when we had open-fronted gardens, and hadedas and criminals were both still relatively scarce in the suburbs.

Bear with me for a second as I quote something from a source which provides great insight to the characteristics of engineers – *Engineers like to solve problems. If there are no problems handily available, they will create their own problems. Normal people don't understand this concept; they believe that if it ain't broke, don't fix it. Engineers believe that if it ain't broke, it doesn't have enough features yet."* - Scott Adams, The Dilbert Principle.

In a perfect demonstration of this quote, my father, the engineer, decided to fix a problem we did not know we had (weren't we just missing some fish?), in a way we did not understand (call me stupid but could we not buy more?). So the fully-functioning-fishless-fish pond (actually now just a pond) was speedily dug up. Great plans were hatched for a bigger, better fish pond boasting many new features, a fellow engineer was consulted about a new-fangled concrete he had invented which might just be the trick for throwing a new pond etc etc….. The end product resulted in a guaranteed talking point amongst friends and family alike, and the conversation usually went something like this…

"So…..um…, what's with the big hole outside your front door?!"

14 years later my parents moved house and the hole was finally filled in. We never did know who took those fish.

I have since realised that the fastest way to get an engineer to fix something is to threaten or attempt to do it yourself or ...

NEGATIVE 3: THEY NEED A LOT OF SPACE TO DO SO

I have vivid memories from my childhood of my mother parking the previously-mentioned, non-reversing, aubergine Volvo in our garage and us all trying to 'teleport' our way out of the vehicle, as opening the doors in the crowded garage was all but impossible. Engineers are notoriously frugal and love to horde things for that 'just in case' possibility – my father was no exception. He was quite happy to tinker away a whole Saturday in the garage; sorting nuts and bolts into little yellow-and-red-capped glass jars (you know, the Colman's mustard jars), clothed in his 'glad rags' (a 'Mauritian' honeymoon shirt that was quite literally hanging onto him by a thread and a pair of shorts that were just short of indecent) whilst humming away to Solid Gold radio. In an alarmingly short space of time the garage was swallowed up and then consumed by my father's seemingly insatiable hording habit – the family car never saw the inside of the garage again.

I came to understand that Engineers need space; they need their 'man-cave'. Quite often a horded piece of 'junk' came to the rescue and my father (somewhat smugly) used it to fix something around the house – thereby justifying his existence in the 'man-cave'.

I finished my apprenticeship and began my higher education when I started dating Roger Peter Bernard Price – great grandson of Bernard Price (the name meant nothing to me, a non-engineer).

IT ALL STARTED WITH ... MCGUYVER.

Yes, he is to blame for my weakness towards good looking men, armed with tools, who can fix just about anything. If the producers of the show had just cast McGuyver as a geeky-looking Dilbert nerd, obsessed with his Leatherman (which, let's face it, is a far more realistic picture than the one they sold us), my life may have turned out quite differently. But they didn't, and so not surprisingly, I found myself dating an engineer, thereby moving a few steps closer to fulfilling the prophesy that follows anyone who has grown up with an engineer - remember the guarantees I proposed earlier?

Invited for tea to the family homestead in Sandhurst, and feeling slightly intimidated by the address, I drove in with visions of grandeur and opulence, rolling green lawns, Jacaranda trees and tennis parties. Instead, I stumbled upon a 'man-cave' inhabited by a wild-looking creature; clad in decidedly indecently-short shorts and a torn shirt, bent over a hunk of un-identifiable, greasy metal (an old lawn mower it turns out- 1 of many) – whilst inadvertently displaying a plumbers 'crack'.
"Dad?" I almost asked.

From the start I felt right at home and that was how I came face-to-face (or face-to-butt) with my future father-in-law, Roger Christopher Bernard Price, grandson of Bernard Price, son of Roger Bernard Price and father to my then boyfriend Roger Peter Bernard Price (spot a trend?).

Dating Roger introduced me to many of the problems that non-engineers struggle with in engineers. If we were going to make the relationship work, I would have to try and find solutions.

The first problem I encountered was rather a hazard to a burgeoning relationship.

Problem 1: **engineers are not very good at communication or relationships (or is that just a guy thing?)**
Solution: find common ground or interests. Turns out I do have something in common with engineers. I love fantasy and sci-fi movies and have been known to voluntarily sit through a STAR WARS marathon!

Transformers nearly moved me to tears (I am talking about the movie). My husband was slow to discover this quality, in fact when quizzed about his favourite movie on our first date, he announced that it was the English Patient (wow, too good to be true I thought) …and that he cried when watching it (definitely too good to be true). After drilling him through a matric-film-study-type appraisal of the movie (ok – it seems he did watch it) we soon discovered that we both enjoyed similar movies.

Engineers are so practical, which has the negative side effect of killing romance – stone dead. Never has this been made clearer than the time I thoughtfully put forward a few Christmas present ideas to Roger – complete with suggested shop names, locations etc…. he promptly responded by asking me, *"Can't you just buy your own present?"*

It is the only time he has ever rendered me speechless, and that was only for a few minutes – the lull before the storm. On one such similar romance-killing-spree, when accused of never buying me flowers, his quick response was *"Ask my mother how many times she got flowers from my father!"* I conclude therefore that a lack of romance is also a common engineering trait.

In line with his practical nature, Roger suggested building model gliders as our next date –I should have seen the romantic candlelight dinners disappearing into the distance at a rapid rate. As a design student I had plenty of experience with model building and thought this would be a no-brainer, certainly not romantic, but good common ground for relationship building. Everything went well until he presented me with my components to assemble and the casual instruction, *"Just convert the inches to centimetres… here, you may need this calculator"*. MAY need a calculator!! I went into a cold sweat as I stared at this calculator (one could be forgiven for mistaking it

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... don't ask questions you don't want honest answers to.

for a laptop) which did not look anything like the R25 one I often use - purchased at the intersection of William Nicol and Peter Place. Thankfully, my engineering boyfriend patiently spoke me through it all step-by-step and I was able to calm down from a flat panic to just a sweaty palms state - which did present some further challenges to the model building exercise. But we finished, and in a geeky-engineer moment Roger named the glider 'Angie' – it was about as close to romance as he got.

Q: How do you drive an engineer completely insane?

A: Tie him to a chair, stand in front of him, and fold up a road map the wrong way… or better yet, just crumple it up into a large ball. This is guaranteed to drive him certifiably insane.

How do I know? Well I tried it of course.

One of the other common interests we share is a love of travelling. Recently we drove around Scotland for a week, armed with a fold-out map which, when unfolded practically filled the interior of our small rental car. As the navigator it was my responsibility to map read and navigate, something I thought I was fairly good at until I met my husband. Sure, the fact that I get my left and right mixed up about 70% of the time is a fairly serious impediment to any navigator. Roger, however, seems to have a sixth sense for direction; I don't know if this is an engineering thing or not – is it? I eventually got the hell-in with trying to painstakingly fold the map along the lines every time I consulted it, and in a moment of pure frustration I simply crumpled it up and threw it on the floor. This thoughtless act very nearly cost us our lives. Who knew that such a simple motion would illicit such a violent response from an engineer! Not me – duly noted however for future reference.

Travelling together just after we were married exposed me to another engineering trait.

Problem: engineers LOVE gadgets
Solution: buy him gadgets that are mutually beneficial to both parties (where is your mind?!!!)

The more functions, buttons, lights and wizzy bits the said gadget has – the better. Whilst travelling through Switzerland it was a given that we would invest in some of the best Swiss engineering available and so (with an all-too-easy swipe of the credit card) Roger bought himself a titanium watch with rotating parts, touch-screen functionality and about a 100 other not-really-needed-but-pretty cool functions. Little did I know just what a valuable purchase it would turn out to be.

After flying to Germany from Switzerland, an old flat mate of mine collected us from the airport. She happened to remind us, as we loaded up the car, that she was still trying to get used to driving on the wrong side of the road – something she was finding a challenge especially after living carless in London for the last 7 years.

We did not find this comforting on a cold, dark December evening. I found myself sitting in the front seat when a folded up map was deposited onto my lap along with a request to find our location on it. *"Um… which direction are we going in?"* I asked whilst trying to figure out which way up the map went. As the 2 blonds attempted to navigate (I am actually blond) we became aware of an eerie, green glow from the back seat, accompanied by some muttering interspersed with 'beeps' …followed by more mutterings which sounded like *"… mmm nope this can't be right"*…'beep beep'.

After re-confirming our supposed direction of travel with our nervous driver, Roger proudly announced that we were going in the wrong direction. This proclamation was met with a synchronised chorus of *"How do you know?"* to which he replied *"My watch told me so."*

European trip: R 40 000
Watch: R 5 000
The look on Rogers face at that moment:
Price…less

Problem: engineers like to work alone and are very territorial.
Solution: there is no solution to this one – just leave them alone to get on with it.

Recently some of our non-engineering guy friends joined together to form a DIY club. Membership of this club entails going to each others' houses on a chosen weekend, drinking beer and all working together on each other's houses/DIY jobs... followed by more beer drinking. To me it seemed like the perfect solution to finally having the dripping tap fixed - the male version of book club perhaps?

When I suggested the idea to Roger I may as well have suggested wife swapping! The idea of someone else using his tools, fixing his stuff and doing a job that only he could really do properly – unthinkable.

A while ago our garage door stopped functioning. In his defence, my wonderful husband did spend several evenings out there after work, diligently testing the door, linking it up to his little electricity-measuring-thingy-ma-gig box and testing the circuit.

When my biceps became alarming larger from days spent lifting the garage door, I eventually called in a professional – the garage door technician.

Making idle chit-chat whilst he got all his tools ready I proudly told him that MY husband, THE electrical engineer, had tested the door and could not find the problem, therefore there must be something SERIOUSLY wrong with it!

I have come to realise that there is an unacknowledged rivalry going on between electrical/mechanical technicians and the degreed professionals.

Whenever I mention to any service/handy-man that my husband is a qualified electrical engineer, it's like an invisible gauntlet being thrown down and someone shouting "game on!"

I regularly get told how the electrical engineers think they know it all; they spend too long behind a computer and don't understand the real picture…blah blah blah.

With a gleam in his eye the garage door technician pointed to a dangling plug. *"And this?"* he queried. *"That"*, I said, taking a wild guess and pointing to a plug socket nearby, *"…should go in there?"* *"Yup"*, agreed the technician, who promptly plugged it in, activated the garage door, climbed down the ladder and scribbled out his R450 invoice with an air of I-told-you-so triumph.

In a nutshell, being married to an engineer results in the following dilemma:

- although engineers are great at fixing stuff they work such long, hard hours that they seldom have time to fix anything at home;
- but they earn good money so possibly one could pay for someone else to fix it;
- but then you will never hear the end of how shoddy the workmanship was, no matter who you hired or how much you paid;
- which leaves you back at square one – waiting for your engineer.

Lastly, and I am not sure if this one is a problem or an attribute:

Problem/attribute: engineers are very honest.
Solution: don't ask questions you don't want honest answers to.

I would imagine that this is a great attribute especially in corporations where engineers are handling multi-million dollar contracts. Asking "where did that million dollars go to?" and getting a whole series of spread sheets, mind-bending formulas and colour co-ordinated graphs in response, must be reassuring. However, in a personal relationship it is something of a liability. Just the other day I asked the age-old question: *"Love, does my butt look big in this dress"* To which Roger rather promptly replied *"If you think it does; then it probably does."*

On a more serious note, I am blessed to have married an amazing man and been welcomed into such a wonderful family. It is a privilege to walk alongside someone who is passionate about his work and his family. Sure he works long hours, but I know he does it because he loves his work and he believes in his heart that he can make a difference. And that is what I think really defines a true engineer.

IN CLOSING…

Being married to an engineer, and being a member of the Price family, comes with so many advantages it's hard to name them all, but let me leave you with a few:

- Naming 1st male heirs is easy (generally Roger Bernard Price gets the nod of approval);
- We get invited to the SAIEE Bernard Price Memorial lecture each year and enjoy a delicious dinner afterwards (thanks SAIEE);
- Since each and every male on our side of the family is a qualified engineer, I recon we ought to be able to weather any storm – so when the lights do finally go out at Eskom we should be ok…even if all we have is a packet of Price candles. wn

Earn CPD Credits

Reminiscing on an Electrical Engineering Career

BY I LT COL BILL BERGMAN (RTD)
MMM **I** PR TECH(ENG) **I** F SAIEE

When I turned 16, I told my father that I wanted to be an electrical engineer. His reply was that I should first become an apprentice electrician in order to learn the know-how of putting things together.

Now I know that the real reason for my father's reply was that they could'nt afford to send me to university. We lived in Bloemfontein and that would've meant that over and above tuition fees, my parents would have to cough up for accommodation, spending money, books and lots of other things that a young man needs when living away from home.

So, it was on the 3rd April 1953 that I signed my apprenticeship papers and started to work as an "appie" with an electrical contracting firm in Bloemfontein. You were managed by a journeyman and you didn't argue when he gives you a menial tasks to perform. I learnt to dig trenches, chase walls, thread steel conduits, climbed in roofs to wire houses and so on. Our day started at 08h00 in the morning and finished at 17h00. After work, all the apprentices had to go to "Tech" - the Technical College, which was situated in the middle of Bloemfontein. Classes started at 17h15! Since most 1st year appies where too young to have a driver's license, we all had bicycles and had to pedal like crazy to get to Tech on time. Luckily in those days, Bloemfontein was not as big as it is today, and somehow we always made it on time.

However, appies are resourceful people and some days we just wanted to "jol" instead of attending classes. The light fittings in the classrooms in those days were mainly incandescent lamps, so in order for us to get out of class earlier, we used to place a copper "penny" (1 cent) piece inside the lamp holder and replace the globe whilst the lights were off. Needless to say, as soon as it got dark, the lecturer used to flip the light switch on and the fuses used to blow! Being too dark to continue the lecture, we were out of there and off like a dirty shirt to pursue other pleasures!

Happily, I can report that I managed to study, and after 4 years of my apprenticeship, I obtained what was known as ATC1. Due to this qualification, I was informed that I could complete my apprenticeship one year earlier, but I would be required to take a trade test in order to obtain a wireman's license. This trade test was done in two parts. One had first to pass a written examination on the wiring regulations. This was based on the famous "Blue Book" which was the Regulations for the Wiring of Premises. Once you had passed this written examination, you then had to present yourself at the Technical School and

Reminiscing on an Electrical Engineering Career

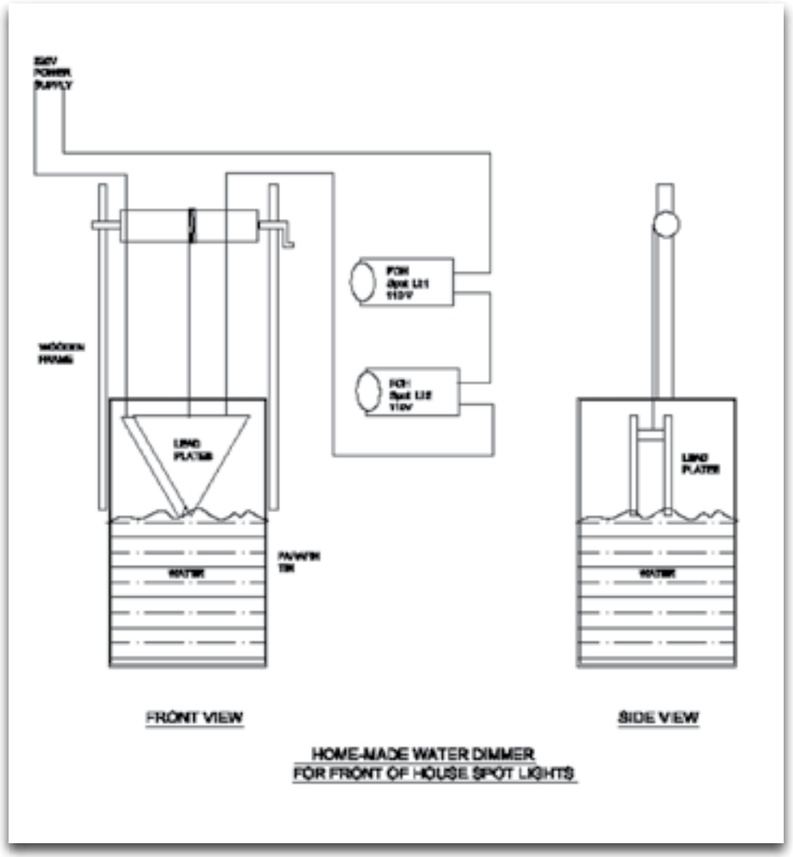
continues from page 53

I was told by the Section Leader to print the alphabet and I must have done this for weeks until he was satisfied that I could start any real drawings.

complete a practical exam. One was given a star delta starter and a small 3-phase motor without any markings. You were given a bell and battery tester and had to ring out and work out the circuit, then connect this to the motor. The examiner overseeing the test, plugged this into a socket and checked that the motor worked as it should. I am sure he received a few surprises in his day.

We were given a blank wooden board, black steel conduit, conduit fittings, wire, switches and a lamp and lamp holder. One had to bend and layout the conduit to the exact measurements as shown on a given diagram and wire the switches and lamp for a two-way switching. The examiner then came along with a tape measure and checked that the circuit worked and that the layout of the conduit was exact. Finally one had to make a "married" joint in a single core cable. Again the examiner stripped this joint down to check that you had applied the insulation tape correctly and that the joint was properly soldered.

During this apprenticeship period, I became interested in amateur theatricals concerning the lighting for various stage productions produced by the Bloemfontein Reportary Society and the Shakespearian Society. These societies were all amateur societies and they used to produce at least four plays a year. At that point in time, Bloemfontein did not have a proper theatre and the plays were staged in a large hall. This meant that the stage lighting for a play had to be improvised. We managed to get hold of 6 resistance dimmers which we mounted on a board and then someone donated 2 large front-of-house (FOH) spotlights - but these were each wired for 110 volts. A rather dangerous but effective dimmer was designed and built.



HOME-MADE WATER DIMMER FOR FRONT OF HOUSE SPOT LIGHTS

See diagram. We wired the two FOH lights in series with two v-shaped lead plates which were then lowered into a paraffin tin filled with water. At first it did not work so we added a lot of salt to the water. When we slowly lowered the lead plates into the water it started to splutter and boil.

Fortunately, when the lights were at full brightness we had contacts which bypassed the lead plates. One had to read and learn the play so that the lighting could fit the mood of the play as well as to know when to set the dimmers according to the play. An example is the lighting of the back drop cyclorama which if there is a window in the play had to change in accordance with the time of day that the play was taking place. We also learned how to do tricks with lighting such as making ghosts appear in Shakespeare's Macbeth .

I obtained my wireman's license and worked as a journeyman for a few years *(I still have my license and upon a recent enquiry on the validity of it, I was truly surprised to learn that it is still valid!)*.

By this time I decided I wanted to enhance my career and I applied to the Electricity Supply Commission (ESCOM as it was known then) for a position as a draughtsman in Johannesburg. My application was successful and I therefore had to relocate from Bloemfontein to Johannesburg.

The ESCOM drawing office was situated in ESCOM House in Rissik Street, Johannesburg and it was the tallest building in South Africa at that time. We later moved to ESCOM Centre in Braamfontein and a few years later the old ESCOM House was imploded to make way for a new development. Here I virtually had to start a new "apprenticeship" on how to draw!

I was told by the Section Leader to print the alphabet and I must have done this for weeks until he was satisfied that I could start any real drawings. Here my previous wiring knowledge gained as an apprentice came to the fore as I had to design and draw wiring diagrams. Also when designing layouts, I would keep in mind that whatever I designed for some electrician to install, that I should be able to do this myself.

I was lucky to do drawings for various installations required in power stations and these included, Wilge, Ingagane, Taaibos and even the boiler control panel for one of the last chain grate boilers at Vaal power station. One great experience was being sent to Rosherville to assist the resident engineer, where they were building the new Rosherville Central Workshops. The site was so big, that when on an inspection, we used to go around on Vespa scooters. To cut a long story short about my Escom experiences, I eventually landed up running the drawing office at the Rand and OFS Rural Electrification Department at Simmerpan. Later the name ESCOM became known as ESKOM.

On leaving ESCOM after 12 years' service, I joined a number of private firms and over the years rose from being a draughtsman to the responsible position of engineer. During this time I was instrumental as the design engineer for some interesting projects. These included the water purification and pumping plant for Cape Town which is situated at Voëlvlei Dam near Wellington, gas producing plant at Highveld Steel in Witbank, gas and electric furnaces and ovens, a 50 ton smelter crane for Rhokana Copper Mine in Kitwe, a heat treatment oven for Atlas Aircraft Corp. to relieve stresses in completed wing sections, the electroplating workshop for South African Airways, the electrical installation for the first Jumbo Jet hangar at the then Jan Smuts Airport, a Coke producing machine at Wankie Collieries.

All these projects had a large degree of automation and required intricate control wiring as well as instrumentation. In the interim I designed the electrical installation for a variety of building types and the electrical reticulation for housing townships.

After many years with private firms I decided to attest in the South African Defence Force (SADF), but the experience I had in that position must wait for another chapter in the next issue of **watt**now.

However, the essense of my story is to show how one can improve oneself through drive and determination. The real crux of the matter is that there is no substitute for experience and to keep up with the latest technology by reading and learning. There is something new under the sun every day and the engineer who professes to know it all, is yet to be born.

*Part 2 to be continued in the February 2013 issue of **watt**now.*

A BIOGRAPHY

Merwyn Emms

Anyone who has been shown around the home museum of Merwyn Emms will soon realise that they have been with someone quite out of the ordinary. He joined the SAIEE in 1962 and recently celebrated 50 years of membership.

BY | DIRK VERMEULEN **|** SMSAIEE

The Institute salutes him, the oldest and longest serving member of its Historical Section. We are also grateful to him for the many items he has donated to our museum and we are indebted to him for having organised two of our important exhibitions.

Born in Cape Town on 5 April 1924 he matriculated at Marist Brothers. As a boy he enjoyed working with things electrical, including crystal sets. His interest in museums also began to kindle at that time prompting him to start his 'cabinet of curiosities'.

In 1941 he was delighted to purchase a whole crate full of unused obsolete telephones from an auctioneer on the Grand Parade for 2 shillings (about R40 today).

These he set to work between himself, his mother, his grandmother and a friend living in their boarding house and it was these that formed the start of his telephone collection.

After matriculating he completed his Telephone and Telegraph apprenticeship with the South African Post Office and at the same time achieved his Advanced Technical Certificates part I and II. After five years working at several telephone exchanges he reached first grade technician status.

His enthusiasm for his career and his communication skills were soon recognised resulting in his being transferred to the Engineering Training School where he lectured on Automatic Telephony and other subjects. At the same time he gave night classes on Telephony, Radio and Electronics at the Cape Technical College.

Whilst at the Training School he took the initiative to assemble working displays to demonstrate the subjects he was teaching. Management soon recognised this flair and entrusted him with building the Post Office displays for the 1952 Van Riebeeck Festival. Not only did Merwyn make these displays, but his enthusiasm resulted in his being asked to man the stall so that he could be the public face of the organisation.

When Oudtshoorn was changed from manual to automatic telephone working, Merwyn was asked to mount an exhibition of his personal collection of telephones. This display drew the attention of the prime minister, BJ Vorster, and the Postmaster General, Louis Rive.

For the opening of the undersea cable connecting South Africa with the United Kingdom, Merwyn was asked to provide a 5,5 m map showing the cable route which lit up when the prime minister threw the connecting switch.

In 1971 Merwyn was given the job of designing the Post and Telegraph exhibits for the Republic Festival. These had a space theme and at short notice Merwyn took on the job of designing the displays and erecting the surrounding space exhibits. In addition, he designed their float for the accompanying parade through Cape Town. Before the opening, Merwyn gave the Minister (Marais Viljoen) and the Postmaster General (Louis Rive) a preview. After this guided tour, Merwyn persuaded these dignitaries that a Post and Telegraph Museum would be an asset to the Post Office. This proposal was favourably considered and in due course the post of controlling officer was advertised. With his knowledge, experience and enthusiasm, Merwyn was awarded the job from a choice of 8 applicants.

He moved to Pretoria to take up this position at the beginning of 1972. Merwyn was subsequently sent overseas on a 3 week tour of postal and telegraph museums in the UK and Europe. He combined this with 4 weeks leave so that he could include visits to 15 other historical venues including the London Science Museum, the British Museum and Pompeii.

In March 1976 Merwyn was able to mount a public exhibition to celebrate the centenary of the invention of Graham Bell's telephone on the ground floor of the National Bank Chambers in Pretoria Church Square.

Merwyn showing part of his collection of radios to Dirk Vermeulen.

This mini-museum remained open until the Post Office Museum was completed in 1980. At this much grander venue he presented a history of South African postage, philately and telecommunications extensively supported by exhibits with at least 20 animated displays.

While still Curator of the Post Office Museum, Merwyn was released to organise the 75th anniversary exhibition of the SAIEE in the Johannesburg City Hall.

For Kimberley he designed and organised their exhibition celebrating the first street lighting in South Africa. This was followed by his contribution to the design of the Bartholomew Dias exhibitions in Cape Town and Mossel Bay. His 'Communications 83' exhibition in Milner Park featured his robot 'PT' and the result gained medals for design and presentation.

In retirement Merwyn built up his collections on 150 different subjects supported by an extensive library all contained within his much extended house. To support all this he ran a successful film stage prop business drawing items from his extensive collections.

Merwyn researched the history of the subjects that interested him and to this end he assembled a library of 4 500 books. He published 110 articles on Postal and Telecommunication matters in the Post Office monthly newspaper *Postel* and wrote for numerous newspapers and journals as well as for the publications of other societies and institutes including the SAIEE journal *Elektron*.

While still at the museum he gave 30 talks to numerous societies. Since then he has delivered presentations to at least as many again covering a wide variety of topics. Starting from humble beginnings this truly self-made man rose to the rank of Deputy Director of the Post Office and has established himself as an authority on many South African historical subjects. wn

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.

18A Gill Street | Observatory |T 011 487 3003 |F 011 487 3002
www.saiee.org.za

Mentorship

The offer comes at a time when our country is suffering a shortage of skills, and we believe that mentoring is an essential requirement in the training and development of the next generation of engineers. If, as a member of the SAIEE, you believe that you need a mentor you can request a mentorship service from the Institute.

The service will be of particular benefit to those young engineers working under the leadership of busy and pressurized Professional engineers, who may not have the time to assist young engineers in discussing and planning their career paths.

This initiative is particularly relevant to young engineers who are working in an environment devoid of engineers or with non technical managers. The young engineer may feel frustrated because he or she cannot benefit from the wisdom of an experienced engineer.

It will give a young engineer, the mentee, a chance to talk to a mentor, who will be his or her advisor, teacher and role model, away from the work environment. His or her mentor, matched to a similar profile, will understand the mentee's work and personal situation, having been there him- or herself.

The mentee will be able to discuss problems and frustrations with his independent mentor, who would have no stake in the outcome, and who would be able to provide an unbiased opinion and advice. The mentee might not be able to do so with his superiors, particularly if he is unhappy, and is considering an alternative career. The mentor and mentee could arrange to meet regularly, on terms that would suit both parties. The goal is to ensure both Mentee and Mentor have enough time to communicate any concerns or advice they have.

The mentor could recommend to the mentee what course of action to take without being too prescriptive while the final decision and the consequences remain with the mentee.

Among its more than 5500 members the SAIEE has many experienced engineers who are willing to act as mentors. They are spread across the country and include engineers who are experienced in steelworks, furnaces, rolling mills, mining, manufacturing, electrical generation, transmission and distribution, through to light industrial, process control, instrumentation, telecommunication, robotics, automation, software development and engineering management of these sectors.

So if you feel that you would benefit by talking to a mentor, please contact Sue Moseley on the number below. She has a database to match the profiles of mentors and mentees. wn

SAIEE

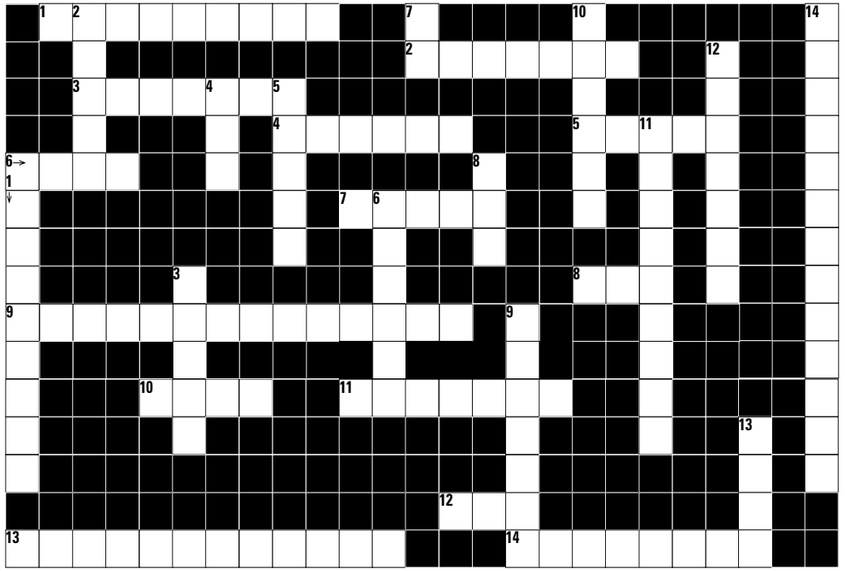
PROSPECTIVE SAIEE MENTORS

If you feel you that you have the time and interest to help mentees, please contact Sue Moseley on 011 487 9047 or suem@saiee.org.za.
In addition you gain CPD credits for when you are required to re-register.

Have some fun and stand a chance to win R1000. Complete the January issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, January 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 **28 February 2013**. The winner of R1000 will be announced in the April 2013 issue of the **watt**now magazine.

win R1000

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



ACROSS

1. A high temperature gas-cooled reactor. (9)
2. Who will be the 2013 SAIEE President? (4,3,7)
3. Name one of the Nuclear Powerplants in South Africa. (7)
4. You, our valuable_____. (6)
5. Nuclear Energy Corporation of South Africa (abbr.)
6. Pebble Bed Modular Reactor (abbr.)
7. See 6 down.
8. See 2 across.
9. What should take place for a nuclear reactor to create energy? (7,7)
10. Southern Africa Power Pool (abbr.)
11. A high-temperature gas-cooled reactor. (7,7)
12. How many nuclear plants does South Africa have? (3)
13. Name one of the three countries who, combined, provide 50% of the world's nuclear generated electricity. (6,6,)
14. The name of the Uranium Project, situated in the Karoo Basin. (8)

DOWN

1. What is the name of the only Research Reactor in South Africa? (9)
2. Which company supply ± 45% of Africa's electricity? (5)
3. See 13 across.
4. Electricity Resource Plan (abbr.)
5. Renewable Energy is also known as _____ energy. (5)
6. Who is considered a major figure in the discovery of nuclear energy? (6,5)
7. Not off (2)
8. Percentage of energy Nuclear Plants provide in the world. (3)
9. See 11 across.
10. See 13 across.
11. World renowned Nuclear powerplant disaster in 1986. (9)
12. What was discovered in 1789 by Martin Klaproth? (7)
13. See 2 across.
14. Who discovered the neutron in 1932? (5,8)

October issue answers:

ACROSS 1 Maxime Faget **2** Aeronautics **3** Astrodynamics **4** Columbia **5** Newton **6** United States **7** ELU **8** Tsiolkovsky **9** ISS **10** Lunar **11**Curiosity **12** Lilienthal **13** Mark

DOWN 1 Kari **2** Moon **3** Anti **4** Astronautics **5** Otto **6** Isaac **7** Shuttleworth **8** Soeviet Union **9** Konstantin **10** SOL **11** Sputnik **12** Apollo **13** Visa

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 28 February 2013. 8. The winner will be announced in the April 2013 issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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

FEBRUARY 2013

4-5	CSP South Africa 2013	Pretoria, RSA	www.csptoday.com
4-7	African Mining Indaba	Cape Town International Convention Centre	www.miningindaba.com
19-21	Africa Energy Indaba	Sandton Convention Centre	www.energyindaba.co.za
21-26	16th Biennial International Symposium on Toxicity Assessment	MSC Opera, Cape Town	www.naturalscience.co.za
25-28	2013 IEEE International Conference on Industrial Technology	Cape Town International Convention Centre	www.icit2013.org

MARCH 2013

12-16	2013 IEEE International Conference on Orange Technologies	Tainan, Taiwan	conf.ncku.edu.tw/icot2013
13-14	4th annual IT Leaders Africa Summit	Johannesburg, RSA	www.kineticevents.net
13-15	iEECON 2013 : International Electrical Engineering Congress	Chiang Mai, Thailand	www.ieecon.org
19-22	Conference on Systems Engineering Research 2013	Georgia Institute of Technology, Atlanta, USA	cser13.gatech.edu

APRIL 2013

8-11	Power & Electricity World Africa	Sandton Convention Centre	www.terrapinn.com
8-11	Power Generation World Africa	Sandton Convention Centre	www.terrapinn.com
9-10	Sustain & Build Africa	Sandton Convention Centre	www.terrapinn.com
9-10	The Lighting Show Africa	Sandton Convention Centre	www.terrapinn.com

MAY 2013

4-6	Led Expo Mumbai	Mumbai, India	www.biztradeshows.com
8-9	Electrical Manufacturing and Coil Winding Expo	Frontier Airlines Center, Milwaukee, USA	www.biztradeshows.com
14-16	Pumps Valves & Pipes Africa Exhibition	Gallagher Convention Centre, Midrand	www.biztradeshows.com

ADVERTISER LISTING

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.

www.feedachild.co.za | www.facebook.com/feedachild1

SAIEE COUNCIL MEMBERS

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