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SAIEE SUPPORTS ENERGY EFFICIENCY AND THE ENVIRONMENT

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SAIEE THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | **APRIL 2012**

SANEA

The South African National Energy Association NPC

Energy People Working Together

SANEA congratulates the SAIEE on the appointment of their new President.

***"Energy People Working Together"* is our Mission and we invite you to becoming engaged by:**

- Joining as a Member
- Nominating for the Energy Awards

Call for Nominations for the

SANEA ENERGY AWARDS 2012

Nominations for the prestigious SANEA Energy Awards 2012 are now open!

Deadline: Friday, 29 June 2012

The Awards Banquet is planned for 27 September 2012

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Member Committee WORLD ENERGY COUNCIL

CONSEIL MONDIAL DE L'ÉNERGIE

For sustainable energy

contents

wattnow magazine

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SAIEE

SAIEE 2012 OFFICE BEARERS

President	Mike Cary
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Junior Vice President	André Hoffmann
Immediate Past President	Andries Tshabalala
Honorary Treasurer	Viv Crone
Honorary Vice President	Roland Hill

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It's this time of the year again - the days are getting colder, the trees are changing colour, the smell of wood burning is in the air, and the sky is azure blue. Once you've checked all the above on your autumn-check list, you know it's the season of the SAIEE AGM.

I introduce you to the 2012 Office Bearers on page 10, this you will find after reading our new SAIEE President, Mike Cary's inaugural speech on page 6.

On page 20, you will learn more about Renewable Energy, which ties in with Mr Cary's presidential theme for 2012 - Energy Efficiency & Renewable Energy Resources.

Page 22 features Energy Savings & Loss Reduction Opportunities, which tells us about the fundamental differences between DC resistant values of various conducting elements.

South Africa is a lightning prone country and it records some of the highest lightning strikes per square kilometre in the world, and The South African Weather Service Lightning Climatology teaches us more on page 30.

Lightning photography is a subject of interest for photographic hobbyists, but a photograph of lightning can also provide us with significant information for scientific research purposes - read more on page 38.

On page 62, I introduce the staff who forms an integral part of the institute and who keeps the machine well oiled in the every day running of the SAIEE.

On this note, I would like to thank you for your contributions to the **wattnow** magazine - without you, this magazine will only be… another engineering magazine.

Enjoy the read!

Minx

Earn CPD Credits

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

ALL SAIEE MEMBERS!

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

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

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

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

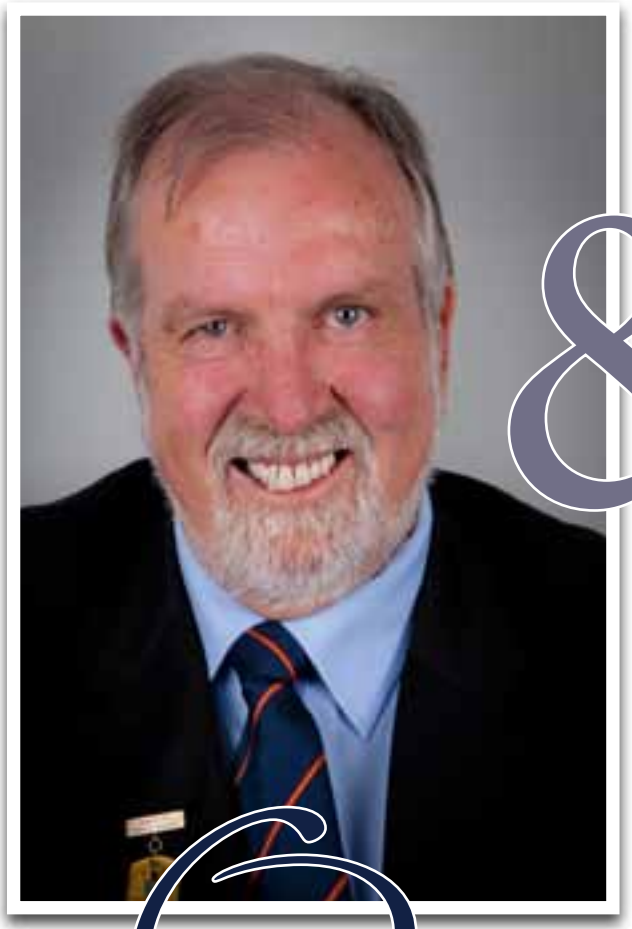
ARTICLES WILL BE JUDGED ON THE FOLLOWING CRITERIA:

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

Awards will be made at the Annual SAIEE Banquet for the best article in each category, published between September and August of the past year. Note that a prize for each category is available but will only be awarded if articles are judged to be of a sufficient standard. The prizes for 2012 will be Apple iPads. The judging panel will be made up of experienced members of the Engineering fraternity, including academics and industrialists and their decision is final. Detailed rules are available on the SAIEE website - visit www.saiee.org.za

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

SAIEE
South African Institute of Electrical Engineers



Energy Efficiency & Renewable Energy Resources

Over the past century, mankind has beneficiated the Earth's natural resources to improve their standard of living. In the process, many of the non-renewable resources, mainly fossil fuels have become depleted to a stage approaching complete exhaustion. This has had the effect of increasing the cost of these increasingly scarce resources, thus incentivising people to look for alternatives, as well as investigating means to use the existing resources more productively. In parallel to these initiatives, there is great pressure from environmentalists to limit the use of fossil fuels because of the pollution associated with their use, which leads to global warming and climate change.

ENERGY EFFICIENCY (EE)

The World Energy Council (WEC) defines energy efficiency improvements as "a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The WEC further states that from an economic perspective, "energy efficiency has a broader meaning: it encompasses all changes that result in decreasing the amount of energy used to produce one unit of economic activity" (1)

In a McKinsey report on unlocking the potential of energy efficiency in the US economy, it was stated: "..the U.S. economy has steadily improved its ability to produce more with less energy." "Despite numerous studies on energy efficiency two issues remain unclear: the magnitude of the Net Present Value (NPV) – positive opportunity, and the practical steps necessary to unlock its full potential." (2). The NPV is important in calculating the pay-back period and the value of the investment. This situation could be resolved by ensuring that the correct knowledge of the subject is gained. In his paper on Knowledge, M A Rossouw defines "knowledge management is the process humans undertake in ordering and classifying the data they perceive. The important elements of the process are " to acquire, store, consistently classify and categorise, define and characterize,

creation of relationships, and meaningful representation. "Managing data and therefore the organizations knowledge, enables the people in the organization.." to make correct decisions in respect of EE. (3)

In South Africa, EE is supported by the Department of Energy (DoE), and the National Energy Regulator of South Africa (NERSA), and has to date largely been driven by Eskom. Eskom has established an Integrated Demand Management (IDM) business unit which is responsible for EE initiatives. "Demand-side management (DSM) involves technical and behavioral measures driven by a utility in order to influence the demand for electricity" (4) It is obvious that in any project of this kind, the low hanging fruits would be the first to be selected:

Eskom have exchanged old lamps (incandescent globes), for new (Compact Fluorescent Lamps). At the time of writing, some 47 million lamps have been installed. The potential left for this initiative is small, but a further development is the introduction of LED lighting which produces the same level of lighting for even less power input. However, at this stage this technology, utilising low voltage devices, is fairly expensive. "Eskom will initially apply LED technology in the commercial and industrial sectors due to the high load factors on lighting systems."

The next initiative is the solar geyser project, and the DoE has targeted 1 million installations by 2014. This program has far to go as the total installed to date is 220 000 units.

A further initiative in this area is the installation of heat pumps which produce hot water at a consumption of energy which is less than a third of that of a conventional electric water geyser.

Smart meters, and motion detectors which switch lights off when not in use are further tools to eliminate the wasteful use of energy. Smart meters are "Electricity meters" that "have evolved from electromechanical devices registering kWh consumption, into multi-function, multi-service, multi-part systems that incorporate multiple embedded functions." (5) A smart meter is the generic term for a meter with bi-directional communication, with either conventional or prepayment capabilities which can handle dynamic tariffs, and can be remotely controlled and remotely read. Thus smart meters can be employed to switch off equipment when not required, of to limit or shed load under certain network conditions. Further initiatives include the introduction of efficient shower heads, energy efficient motors and motor systems, and waste energy recovery projects.

Many motors are over-rated for their duty, which results in substantially more power being consumed than the output of the motors. "Installing variable-speed drives in all the industrial electric motors around the world would save the equivalent power output of 286 nuclear reactors, according to ABB, and the savings would pay for the required capital investment in one to three years" .(6)

All the above initiatives have obvious economic benefits, and the pay back time for investing in them can be low as 12 months but could also exceed 5 years. However as energy tariffs increase the pay back time will decrease. The NPV calculation should also take the price increases into account.

These initiatives are all part of the Demand Side Management programme. Given the fact that in South Africa presently, the amount of generation capacity available is close to the demand for power, makes the introduction of energy efficient initiatives an important imperative.

GENERATION IN SOUTH AFRICA

In the Eskom Annual report dated March 2011 (7), the nett maximum generating capacity is stated to be 36208 MW in 2001, and 41194 MW ten years later in 2011. This increase is due to the Return to Service programme as well as the installation of open cycle gas generators, and represents a 12,8% increase. During the same period the peak demand (which normally occurs around July) increased from 30599 MW to 36970 MW - an increase of 25,3%. It is obvious that the gap between the two is closing. As good practice, the amount of reserve capacity after demand has been served should be 15% of the nett maximum capacity.

The reserve margin is to cater for planned and unplanned maintenance as well as unexpected trips. This means that as at March 2011, the reserve margin was 10%. Once a generating unit has reached mid-life (about 25 years), it requires substantial maintenance which also means that it will not be available during the period it is maintaned. Five Power Stations totaling 26000 MW are older than 25 years, and a further three totaling 11000 MW will reach that age in the next couple of years.

The Energy Availability factor has deteriorated each year from 85,32% in 2009 to 84,59% in 2011. The total of the planned capacity loss factor and the planned factor has increase from 13,92% to 14,12% during the same period. (7,8)

Energy Efficiency & Renewable Energy Resources

On the plus side, there are currently three power stations being built which will start adding over 10000MW to the grid from 2012/3 onwards.

Analysing the sources of generation from the report, 34952 MW comes from coal-fired stations, 2409 MW from gas/liquid fuel, 600 MW from hydro electric, 1400 MW from pumped storage, 3 MW from wind, and 1910 MW from Nuclear generation. It can be seen that renewable generation accounts for only 1,5% of the capacity currently.

MITIGATION ACTIONS FOR LACK OF GENERATION CAPACITY

The Demand Side Management programme has yielded a verified demand savings of 2717 MW for the period April 2004 to March 2011.

The System Operator is responsible to ensure continuity of supply, especially under constrained generation conditions.

Other measures used by the System Network operator include: (9)

- The use of Municipal Base Load (515 MW).
- Independent Power Producers and Short Term Base Load (100 MW).
- Power buy back (1000 MW).
- Additional Demand Market Participation (200 MW).
- Emergency Demand Market Participation (200 MW).
- Demand Response Aggregation Pilot Project. (500 MW) . Andrew Etzinger said "We are excited to launch the Eskom Demand Response Aggregation Pilot Project (DRAPP) to leverage the power of demand response to help ensure greater grid reliability across South Africa." Eskom have chosen Comverge's Software Platform for this pilot project.
- Non-Eskom Peaking Generation (160 MW).
- Renewables - Eskom expects that these will only be available from 2013 onwards (see below).

OTHER SOURCES OF GENERATION:

Renewable Energy Resources (RE)

As mentioned above renewable energy represents only 1,5% of the current Eskom generation capacity. The DoE published the Integrated Resource Plan 2010 in March 2011. This is a 20 year blueprint or master plan for energy in South Africa. It was extensively work-shopped by all stakeholders, and adjusted for various factors. It will be reviewed bi-annually, to take into account changing circumstances. In terms of this plan a further 42,6 GW should be built by 2030. Of this 15% will be coal, 23% nuclear, 6 % hydro, 15% gas, and 42% renewables. The renewables will consist of 8,4 GW wind, 1,0 GW concentrated solar power, and 8,4 GW Solar Photo-voltaic (PV). (10)

Recently, the DoE issued an enquiry for the first part of phase 1 for Independent Power Producers to tender their technology and a price per unit supplied (the Renewable Energy Bid process or REBID). Tenders were received for Wind Power (634,0 MW), Photo-voltaic Power (PV) (631.5 MW), and Concentrated Solar Power (CSP) (150 MW). There were 28 bidders, and the total value was 50 billion Rand.

This was the first phase of four enquiries to produce 3625 MW of renewable Energy consisting of wind power, photo voltaic power, concentrated solar power, bio–energy, and mini–hydro schemes. (In terms of the Country's Integrated Energy Plan, 2010 – IRP2010). The phase 1 IRP2010 allocation per technology is 1450 MW for PV, 1850 MW for Wind, 200 MW for CSP, 75 MW for small hydro's, and 50 MW for small gas projects (Biomass, Biogas, and landfill).

It is interesting to note that within 45 seconds the solar energy received by our planet is sufficient to fully meet the world's entire energy needs for that day (11). The continental solar radiation is 2300 times the total average daily consumption of total energy (including all forms). In 2010 the installed capacity for PV was 41 GW, of which 17,2 GW was installed in Germany. Wind energy also has the potential of producing 14 times the world's consumption. In 2010 the world total installed RE capacity was 312 GW, of which 61% was wind, 22% bio mass, and 13% solar PV.

From the year 2008 to 2035, the global demand for electricity generation is expected to grow by 75%. In 2008, renewables accounted for 3% of the generation, coal 41%, gas 21% hydro 16%, and nuclear 14%. In 2035, renewables are forecasted to grow to 16%, while coal would be 32%, and gas, hydro, and nuclear would remain the same. (12)

Renewable energy has disadvantages as one requires the sun to shine, the wind to blow, or water to flow to generate power. The intermittent nature of this power can be compensated for by the provision of energy storage. The storage, however, can be relatively expensive but the prices are decreasing with advances in battery technology. Alternatively, the grid into which this power is fed should have reserve power capability which can be switched on in a short period of time, when the renewables are not available (due to weather conditions etc).

Given the scarcity of water in South Africa, the main contenders for additional power generation would be wind and solar. However, given the disadvantages of wind and solar, and the current relative expense of these technologies and their technological shortcomings , the percentage of renewables on the grid would be between 5% and 10% of the total generation capacity.

It must be noted that the addition of renewable energy resources for generation, is not an energy efficient initiative. However the application of these technologies must implement EE principles. Eg, low-loss wind generators should be installed and system losses minimized.

In conclusion, it is the duty of every citizen, organization and business in South Africa to strive for maximum energy efficiency. Power availability is the life blood of our economy, and every contribution to ensure demand does not exceed supply, is a contribution to the well-being of South Africa and its people.

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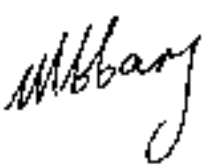

Mike Cary | SAIEE President 2012

OFFICEBEARERS 2012

PRESIDENT
MIKE CARY

Michael Charles Cary, B Sc Eng (Elec), B Comm (Admin), AEP (SBL), born on the 6th of September 1945, started his career as a Pupil Engineer at Eskom. His biggest opportunity came when he was appointed Managing Director of Rotek Engineering. During Mr Cary's career, he transformed 5 companies from loss to profit. His life's philosophy is: "Do it right first time, do what you need to do to get the job done, do not engage in unnecessary verbal sessions". Although he has officially retired, Mr. Cary does consulting work for 2 companies, and is Chairman of the Board of a BEE Company. In his spare time he enjoys reading well-researched historical novels.

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DEPUTY PRESIDENT
PAUL VAN NIEKERK

Mr. Paul van Niekerk,[PvN] is a registered Professional Engineer, has a GCC and is currently the Executive Director of PIESA. He started his career as an Assistant Protection Engineer at the SAR&H laboratory in 1967, and started a Municipal career in 1971 which extended some 30 years, culminating in 2003 when he was instrumental as part of the team that were responsible for the conversion of City Power from Municipal Electricity into a corporate entity. Mr. Max Clarke, who was Town Engineer in Newcastle in 1971, had the greatest influence on Paul and his career. Mr. van Niekerk's life philosophy is: "To do the best that I can and to do it as soon as possible." To relax, Paul enjoys watching rugby as well as investigative crime series' on TV. He has a wide taste in music, but primarily enjoys the classics.

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SENIOR VICE PRESIDENT
DR. PAT NAIDOO B Eng, MSc, MBA, PhD,

Managing Director of his own company, Pat Naidoo Consulting Engineers Inc. RSA, made his professional best achievement of retiring at 50, a dream come true. Dr. Ian McRae, chief executive of Eskom, 1985 to 1994 had the greatest influence on Dr. Naidoo's life with Mr. Barack Obama being a person he would love to meet. His philosophy on life "Keep it simple" mirror's Dr. Naidoo's outlook on life without any strings attached, what-you-see-is-what-you-get with this enigmatic personality. His favorite past time read is the Harvard Business magazine and he enjoys watching BBC.

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JUNIOR VICE PRESIDENT
ANDRE HOFFMANN

Mr Hoffmann has thirty three years experience in the telecommunications and Information Technology industries. He is currently the Chief Engineer at Broadband Infraco and responsible for Transmission and IP Network Strategy, Network Optimisation, Evolution and Engineering, Technology sourcing. He enjoys getting involved in DIY at home and gardening and is currently building a water feature and experimenting with cacti and bonsai. André loves going for nature walks in the countryside and enjoys reading – mostly non-fiction.

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IMMEDIATE PAST PRESIDENT
ANDRIES TSHABALALA

Mr Tshabalala, B.Sc. Eng. (Elec.); FSAIEE, started his illustrious career as a technical assistant, and with hard work and perseverance, worked himself up to the position of the Group Executive Director of ACTOM. ACTOM has assets valued in the billions and have a staff compliment reaching over 5000. His philosophy on life is: "Do unto others as you would like them do unto you – make friends". In his private time he enjoys watching wild life documentaries and will savour a glass of dry white wine with dinner. Mr Tshabalala's hopes for South Africa is to see our country in a successful, stable condition and free from poverty.

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HONORARY TREASURER
VIV CRONE

Mr Viv Crone was born in Johannesburg in December 1949. He graduated cum laude with a BSc Eng (Elec.) degree in 1972. Viv was appointed CEO of a joint venture company, Energy Measurements (Pty) Ltd., which was formed between Spescom and Siemens. He was appointed as CEO of Spescom DataVoice in 1999. He retired from Spescom in 2010 and now consults to various companies requiring experienced Engineering inputs. He is a Registered Professional Engineer with ECSA and a Fellow and Past President of the South African Institute of Electrical Engineers. He lives in Johannesburg and is a part-time lecturer at Wits in the School of Electrical and Information Engineering. Other interests include Astronomy, Nature Conservation, Hiking and Reading as interests.

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HONORARY VICE PRESIDENT
ROLAND HILL

Mr Roland Hill, M.Sc. Electronic Eng (Natal), started his career in 1979 at Marconi Electronics (UK) where he designed a LCD shutter. He developed silicon chips, video inspection systems and a drive by metering system for the world bank. This led to an innovative period at CBI-electric developing a portfolio of rail mount and prepayment electricity meters. Roland's desire to make a difference in poor communities drove his contribution to turning South African prepayment technologies and standards into a global industry. His "spare" time is now spent building synergies between European smart metering standards and the smart prepayment solutions proven in Africa.

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WATTSHOT

FLEXIBLE SILICONE KEYBOARD

Incredibly flexible PC keyboard made completely from quality silicon rubber. The ultimate in portable and durable, this is a key board that can go anywhere you go, take extraordinary amounts of abuse, and still work perfectly. This standard QWERTY keyboard is "plug and play" with Microsoft Windows OS and works just like a normal computer keyboard (only better!). R149.99 (incl.)

RAZORPIT® RAZOR BLADE SHARPENER

With the patented RazorPit and its friction technology, you can remove the residues of hair and skin that makes your blade feel dull. RazorPit makes your razor blade last for up to 150 shaves. RazorPit uses a unique and patented friction technology to clean and sharpen your razor blades. After every shave microscopical residue, like skincells, water, and keratin is left on the blades. That causes them to feel dull. RazorPit uses friction to clean off the residue and thereby leaving you with a clean and sharp razor blade. It´s just like shaving with a brand new blade every day. At the same time, you save up to 90% on buying new razor blades. R325.00 (incl.)

TOOLLOGIC SL3 FIRESTEEL KNIFE

The SL3 Firesteel survival tool is made from some of the toughest materials know to man, and will withstand even the most challenging of situations. What sets this apart from any other compact knife is its "A" grade serrated blade, tough magnesium alloy construction, uniquely shaped blade, emergency whistle and firesteel fire starter. Retail at R430.00 (incl.)

12-IN-1 MULTITOOL PEN

As anyone who can uses Google knows, it was obscure English novelist and dramatist Edward Bulwer-Lytton (1803-73) who first coined the phrase "The Pen Is Mightier Than The Sword". We're not quite sure what he meant by that, but he was probably thinking of something very similar to the marvellous 13-in-1 Multi Pen Tool at the time. Probably.

In addition to its most obvious function as a svelte, stainless steel ballpoint pen, the 13-in-1 cunningly contains another 12 useful tools (do the 'math') within its sleekly segmented and knicely knurled body - truly this is the Rolls Royce of the Swiss Army Knife of pens!* If you know what we mean...

FEATURES | Ballpoint Pen (obviously) | Hole Puncher | Stainless Steel File | Short Cutting Blade | Flat Screwdriver | Saw | Wire Strippers | Long Cutting Blade | Tweezer | Philips Head | Stainless Steel Fork | Scraper | R189.00 (incl.)

BLUELOUNGE® REFRESH GADGET CHARGING STATION (JET BLACK)

Lay down your wreaths and say your goodbyes – all those bulky chargers littering your home and office are about to bite the dust, thanks to the smashingly sleek Refresh Charging Station.

The ultimate de-cluttering device for power crazy gadgeteers, the stylish Refresh can charge several oojamiflips simultaneously: from phones and iPods to GPS units and bluetooth headsets. Simply plug 'em in to the relevant built-in connector and place on the Refresh's perfectly-angled, removable rubberised tray. As He-Man used to yell: 'I have the power!'.

The Refresh boasts six universal connectors, including MicroUSB, MiniUSB, two full-size USB sockets and a couple of iPod/iPhone connectors, so not only is it Apple-friendly and capable of charging two iWhatevers at the same time, it's compatible with virtually any modern rechargeable gadget. The MicroUSB socket will charge various new mobile phones, from the likes of Nokia, Samsung and Sanyo. Meanwhile the mini USB works with the BlackBerry, Garmin GPS and Sony Ericsson Walkman phone. Bases covered? Absolutely! Fuddy duddies with older mobiles might struggle, but if you're that behind in the tech stakes you should quit gawping at this newfangled interweb thing and stick to tinkering with your penny farthing. R950.00 (incl)

VEHO™ PEBBLE SMARTSTICK

Charge your portable device on the move without the need for mains power. Small and light enough to carry around in your bag, the Pebble Smartstick portable emergency charger will provide your mobile device with up to one additional charge, charging most popular devices including iPhone, iPod, Blackberry, Sony Ericsson and devices that use mini or micro USB.

FEATURES | Rechargeable 2200 mAh battery, up to one full charge on your Smartphone | Small and lightweight | Includes 5 adaptors for use with most popular mobile devices | R450.00 (incl.)

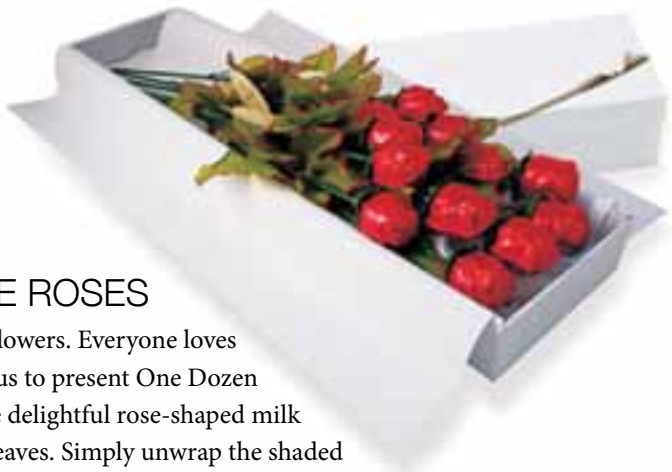
WATTSHOT

13 MAY 2012 is Mother's Day and what better magazine to find the coolest gifts for the special Mother in your life.

STEM VASE

With a central chamber resembling a suspended droplet of water, this thoroughly modern vessel is ideal for single blooms, and will add a contemporary touch to any scenario. Hand-blown, it makes a beautiful gift for Mother's Day or any other day calling for a present with a stylish twist. Better still, you needn't buy a whopping great accompanying bouquet. Designed by Yee Ling Wan and Steve Jones, the Stem Vase is available in two sizes, 30cm & 15cm. Now all you need is a flower.

FEATURES | Made from Borosilicate Glass | Dishwasher safe, although hand wash is recommended | Mouth blown glass vase | Each vase accepts only one stem. R170.00 (incl.)



ONE DOZEN CHOCOLATE ROSES

Unwrap the foil to reveal milk chocolate! Everyone loves flowers. Everyone loves chocolates. With these sweeping statements firmly in mind, allow us to present One Dozen Chocolate Roses. Packaged in a smart presentation box, these delightful rose-shaped milk chocolate blooms are mounted on graceful long stems with silk leaves. Simply unwrap the shaded red foil and enjoy. With twelve yummy roses you can attach them individually to gifts, put the whole bunch in a vase or just scoff the lot in one decadent sitting. A wonderful gift for Mother's Day will see you leap into pole position in loved ones' most original gift buyer chart. **CONTENTS |** 12x Artificial rose stems with milk chocolate flower heads | Milk chocolate is wrapped in red foil **INGREDIENTS |** Sugar, Milk Cocoa Butter, Cocoa, Soy Lecithin - an emulsifier, Vanillan - Artificial Flavourings **DIMENSIONS |** Single Rose: measures approximately 49cm(H) x 4cm(W) x 3.5cm(D) | Single Rose Weight: 21g | R785.00 (incl.)

WEEKEND GETAWAY

All moms love to travel or they have that one special place where they have always wanted to visit yet have never had the chance. Mother's Day weekend is an excellent time to surprise them with those cruise tickets they have been on the lookout for, that concert that seemed to be sold out, or even plane tickets to that exotic island they have saved on their computer screen. Surprise them by helping them have one of their dream vacations. If you like you can even accompany them.

TAKING UP THE DESIGN CHALLENGE

THE GROWING CONSENSUS OF THE NEED FOR GREENER, MORE RESOURCE EFFICIENT WAYS OF LIVING MAKES THIS AN ERA OF EXPLORATION.

Energy efficiency and eco-friendliness are among the main considerations of forward-thinking consumers. They've become top of mind when building, decorating and revamping homes. It's up to us, the people with the know-how, to create solutions that enable them to achieve their green aspirations.

On the lighting front, we've got a head start. Innovation and advancements in energy efficient, long-lasting lighting technologies have ensured that there is now a low energy alternative for almost every lighting application.

There is still a lot of terrain to be chartered as we merge good design with the energy efficient alternatives available to us. We've been given the reigns, we just have to take them. A smart mix of efficient lighting technologies and a clever approach to lighting design, installation and layout is necessary for practical, aesthetic and efficiency requirements to be in sync. Herein lies the opportunity to create, innovate and satisfy.

TAKE IT FURTHER

Have you explored the terrain of energy efficient lighting? Do you have an idea for an energy efficient lighting technology, lamp, system or product? Eskom is inviting designers, innovators, engineers and students to submit their energy efficient lighting innovations to the Eskom Energy Efficient Lighting Design Competition 2012. The goal of the competition is to show that efficient lighting technologies can be used – and mixed and matched – in contemporary lighting designs and systems for homes. Since 1999, the biennial competition has helped mobilise transformation in the market, motivating lighting designers, architects and interior designers to use energy efficient lighting in their portfolios, and inspiring consumers to adopt innovative and green lighting concepts. Participating and being honoured in the Eskom Energy Efficient Lighting Design programme is an accolade that entrants can leverage as a launch pad into energy efficient design and development in South Africa's increasingly eco-conscious residential sector.

There is a total of R214 000 in prize money to be won, as well as the opportunity to be honoured with the prestigious Sparks Trophy
The closing date for entries is the 31st of August 2012.

The competition is supported by Philips, the Radiant Group, LED Lighting SA, Voltex, Eurolux, ARB Electrical, OSRAM, the Department of Energy, the *eta* Awards, 49M, NEEA, NMISA, SESSA, IESSA, Technology Innovation Agency, the South African Institute of the Interior Design Professionals, Miss Earth, Electricity and Control, Sparks Electrical News, Vector, Lighting in Design and VISI magazine.

Full details are available at www.lighting-design.co.za or from Ruth Kolevsohn at ruth@silverroot.co.za

WATTSUP

2012 SAIEE AGM

On 29 March 2012, the South African Institute of Electrical Engineers held its Annual General Meeting in the new SAIEE House Boardroom. Stan Bridgens, Business Director of SAIEE welcomed all present and extended a special welcome to all the Presidents and representative of the sister Institutes and societies. Andries Tshabalala, outgoing President, gave a short overview of the year's business and events.

Mike Cary was inaugurated as the 2012/3 President of the SAIEE. He announced the new Council members and congratulated them on their election respectively. Mike Cary delivered his Presidential Address titled "Energy Efficiency & Renewable Energy Resources".

Members and guests enjoyed the new venue at the new SAIEE Headquarters and enjoyed a few refreshments and networked after the proceedings.

Andries Tshabalala presented Paul van Niekerk with a certificate of appreciation for his work as Chairman of the Building Committee.

Andries Tshabalala presented Viv Crone with a certificate of appreciation for his professional contribution to the new SAIEE House.

Andries Tshabalala presented Silas Moloko with a certificate of appreciation for his contribution to the SAIEE Power section and the promotion of the relationship with the IEEE Power section.

Andries Tshabalala presented Pieter van Vuuren the SAIEE Award for the Best Paper Published in the SAIEE Africa Research Journal.

Andries Tshabalala presented Hermann Broschk with a certificate of appreciation in recognition and acknowledgement of his distinguished service to the SAIEE.

Margaret Cary presented a basket of flowers and badge to Fikile Tshabalala in recognition of her support amd contributions during the past year.

Andries Tshabalala congratulates Mike Cary as the new president of the SAIEE.

Incoming Junior Vice President, André Hoffmann with Mike Cary.

Mike Cary congratulates Thandiwe Nkambula on her election as Chairperson of the Power Section.

Honorary Treasurer, Viv Crone with the 2012 SAIEE President, Mike Cary.

Mike Cary congratulates Max Clarke on his election as Chairman of the Historical Section.

Angus Hay presented Andries Tshabalala with his Past President's certificate.

SAIEE Business Director conversing with Michelle Hay after the proceedings.

Paul van Niekerk, Paul Johnson, Andries Tshabalala and Prince Moyo.

Adrian Schofield
President CSSA

Eric Jacobson
SAIEE Member

Prince Moyo
SAIEE Council Member

Thavenesen Govender
SAIEE Council Member

(L-R) Minx Avrabos, Viv Crone, Barbara Spence and Craig Smith

Hermann Broschk,
SAIEE Council Member

WATTSUP

(L-R) Pat Naidoo, Anthony Falconer, Mike Cary, T.C. Modikane, Robbie Evans, Phumi Ngxonono and Stan Bridgens.

SAIEE HOSTS CENTRE CHAIRMAN WORKSHOP

"The SAIEE is one company and with the growth and creation of additional Centres over the last few years to 5 has it is imperative that the policies, procedures and operations of the Centres and Head Office are essentially the same.

The tradition of the Institute to have a new President and Centre Chairmen every year exacerbates the challenge of ensuring consistency across the board.
It has therefore become essential to have an annual workshop with the Centre Chairmen so that everyone sings from the same page. More important is the welding of a team that dispels the notion of 'them and us" that can so easily manifest itself.

The main driving forces for this annual workshop requirement, apart from the obvious, is the financial audit that takes place end of January every year. A more recent development in the activities of the Institute is the Continuing Professional Development (CPD) courses run as a service to our members and others providing CPD credits required for re-registration by the Engineering Council of SA (ECSA).

It is imperative that the same policies and procedures are adopted by all the SAIEE officials who are involved in financial and CPD events because these are statutory requirements that must be complied with.

Fortunately these workshops have been very congenial and productive - it also provides a marvelous opportunity for the new Chairmen and the Office Bearers and Council to get to know each other very early on in the year after the AGM."

SAEE BURSARY STUDENTS LIVE ON RADIO

Brian Saunders and Sheree Anne Marinus received their bursary cheques during 'live' interviews with Gareth Burley on the SAEE's radio programme The Green Hour with Kingfisher FM. Marishka Singh attended the SAEEC2011 Convention and Exhibition during November 2011 where she was awarded her bursary, but participated in the radio programme via telephone. Each student received R15 000-00 from the SAEE towards their studies in the built environment.

REINVENTING INFORMATION SECURITY

The annual ITWeb Security Summit will take place at the Sandton Convention Centre between 15 and 17 May 2012. This event will feature presentations relating to trust, and the need to re-assess the standard approaches to IT security. This year's theme is: "Reinventing information security: When trusted technologies have failed."

Speakers from around the world will be giving their expertise on the subject matter. Speakers will include Kenneth Geers from the US Naval Criminal Investigative Service (NCIS), White Hat hacker and researcher Moxie Marlinspike will also be one of the keynote speakers presenting at the ITWeb Security Summit.

For more information visit www.securitysummit.co.za

HISTORICAL SITE VISITS

The Institute has recently hosted several groups of visitors who had expressed a desire to see the new headquarters building and the historic Innes House as well as other items of interest located on the Observatory site. They were welcomed by members of the Historical Section who conducted them through the SAIEE buildings and other buildings on the adjoining SAASTA site, including the original 26" telescope of the Union Observatory.

They were also given talks on some of the unique artefacts and other items in the Institute's museum collection, and the impressive contribution made by South Africans to electrical engineering at an International level. Items such as the original prototype Tellurometer and other unique inventions of Dr. Trevor Wadley, the prototype valves that were developed in the USA by the South African Dr. Hendrik van der Bijl which made it possible for New Yorkers to talk directly to the citizens of San Francisco by telephone for the first time, locally produced radar sets that played a vital role in the Second World War and early models of earth leakage circuit breakers, amongst many other things.

Anyone interested in visiting the site and viewing some of the interesting items in the Institute's collection should contact the office on 011 487 3003.

EAST AFRICA TO HOST WORLD SUMMIT BOOSTING KENYA

The Kenya Vision 2030 economic pillar will kick off in proud partnership with the Kenyan ICT Board at the East Africa Outsourcing (EAO) Summit 2012 in Nairobi. Hosted by international business-to-business conferencing company, Kinetic Events; the summit will provide a platform for existing and potential players in outsourcing industries worldwide, looking to reduce costs and efficiency pressures, by outsourcing business processes to East Africa. The Vision aims to maintain a sustained economic growth rate of 10 per cent per annum from 2012, with a focus on macroeconomic stability, infrastructural development; science, technology and innovation (STI), land reforms, human resource development, and security and public sector reforms.

The Kenyan Government and Emirates Telecommunication Technology (Etisalat), together with local investors, launched The East Africa Marine Systems (TEAMS) fibre optic undersea cable project, preparing Kenya with the technology to establish a major Business Process Outsourcing (BPO) park. This reinforces Nairobi as a major international financial hub to accelerate economic growth and gain a stronger presence in Africa's rapidly growing financial services market. The strategic invitation-only summit will explore the alignment of people, process and technology; offering insight into the solutions available to contact centres today, assisting companies in the negotiations and selecting the tools best suited to their needs. For more info, visit www.eaosummit.com

SAEE Appointment

Christi Bester has been appointed as Finance and Registration Manager of the Southern African Association for Energy Efficiency (SAEE).

Renewable energy – what we can draw from the sun, biomass, wind, wave, wastes and earth – has a relatively short operating history. In 2009 (the latest available data from the International Energy Agency), it contributed about 0.4% to the total energy. To be true, it is growing strongly, but during the year, the fossil fuel contribution grew 28 times more than all the renewables.

Renewable Energy and Generation Efficiency

BY I PHILIP LLOYD
ENERGY INSTITUTE I CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

The reasons for this are not difficult to seek. Most of the renewables are intermittent – they only deliver when the sun shines or the wind blows. But the electrical supply industry is challenged to keep the lights on at all times. This means that for much of the renewable capacity, there must be, somewhere in the system, conventional generation that can take up the slack when the renewables are being temperamental.

Conventional generation has a narrow optimum operating band. Its efficiency drops when it is operated in a stop-go mode. Its dynamics are quite different from those of the renewable sources. Load following becomes very complex.

A case in point is Denmark. It has installed sufficient wind energy to meet 20% of its needs, but much of that is delivered when the demand is low, so it has to be sold into a market that is already oversupplied. The price is often below the cost of generation. The reverse occurs when the wind doesn't blow and the demand is high. Power must be bought in a market that is undersupplied, and the price is then high. The result is that the Danes pay one of the highest prices for electricity in Europe, and their wind farms actually provide them with only 9% of their demand. 11% of their demand is sold at a loss and met at a cost.

Our Government policy is to move towards lower carbon emissions. To achieve this target, IRP2010 has included 17.8GW of renewables to be installed by 2030. There are formal enquiries for the supply of this capacity. The latest budget has increased the levy on fossil-fuel power to 3.5 cents per kWh, which is designed to ease the entry of renewables.

However, the contribution that the renewables will actually make to our energy position will not be large. Their load factor is generally low. We will be fortunate if the yield averages as much as 5GW. In addition, the efficiency of rest of the system, which will total about 70GW by 2030, could drop by about 5%, i.e. cost about 3.5GW. Thus the benefit of renewables could amount to as little as 1.5GW.

IRP2010 did not take into account this effect of renewables. However, it is to be reviewed regularly. It is critically important that integration of renewables into the grid be considered carefully at the next review. wn

Earn CPD Credits

Energy Savings & Loss Reduction Opportunities

There are fundamental differences between simple DC resistance values of various conducting elements and actual 'apparent' AC resistances of the same elements. Motors, lighting, facility wiring, distribution panels, protective devices, transformers and switch gear all experience a wide range of phenomena that combine to create wattage (energy) losses.

BY | SCOTT C. SCHINDLBECK
VICE PRESIDENT | DESIGN & ENGINEERING | FCE CORP. INTERNATIONAL

Identifying and calculating the total of all losses is an extremely challenging engineering proposition that requires knowledge of all factors that impact operating efficiencies. The following document provides a simplified overview of the most common and important loss factors in a typical facility. Note that all of these are current (Amps) and frequency (Hz) dependent, and can be reduced by utilizing techniques that reduce facility current usage and filter harmonics.

HYSTERESIS LOSSES

Hysteresis losses are heat losses associated with the magnetic properties of an AC motor armature. When an armature core is in a magnetic field, the magnetic particles of the core tend to line up with the magnetic field. When the armature core is rotating, its magnetic field keeps changing direction. The continuous movement of magnetic particles as they try to align themselves with the magnetic field produces molecular friction, causing heat. This heat is transmitted to the armature windings, increasing armature resistance.

SKIN-EFFECT LOSSES

The apparent resistance of a conductor is always higher for Alternating Current (AC) than for Direct Current (DC). The magnetic flux created by AC interacts with the conductor, generating a back Electro-motive Force (EMF), tending to reduce the current in the conductor. The center portions of the conductor are affected by the greatest number of lines of this force. The EMF produced in this manner (self-inductance) varies both in magnitude and phase through the cross-section of the conductor, being greater toward the center and smaller towards the outside. The current, therefore, tends to crowd into those parts of the conductor in which the opposing EMF is a minimum. That is, into the 'skin' of a circular conductor or the edges of a flat strip. This phenomenon is known as 'skin' or 'edge' effect. The resultant non- uniform current density has the effect of increasing the apparent resistance of the conductor, causing increased losses. Harmonic loads amplify skin effect losses by the square of the increase in frequency above nominal line frequency. Because of this, harmonics are the cause of substantial energy losses in any facility with nonlinear equipment loads, such as VFDs, DC drives, rectifiers, induction heaters or other arcing or switching power supply devices.

PROXIMITY EFFECT LOSSES

Proximity effect exists when conductors are close together, particularly in low voltage equipment, where the interaction between the magnetic fields of conductors causes further distortion of current density. In the same way as an EMF can be induced in a conductor by its own magnetic flux, another conductor can produce an EMF in any other conductor.

If two such conductors carry currents in opposite directions, their electromagnetic fields are opposite, tending to force one another apart. This results in a decrease of flux linkages around the adjacent parts of the conductors and an increase in the more remote parts. This forces a larger concentration of current to the adjacent parts where opposing EMF is at a minimum. If the currents in the conductors move in the same direction, the above action is reversed. This effect, known as the 'proximity effect', (or 'shape effect'), increases the apparent AC resistance. If the conductors are arranged edgewise to one another, the proximity effect increases. As an additional note, in many cases the proximity effect will also tend to increases distribution network stresses under short-circuit load conditions.

TRANSFORMER LOSSES

The two primary types of transformer losses are core losses and load losses. Core losses occur because a magnetizing current must exist in the primary winding of a transformer. This current is additional to current which flows to balance the current in the secondary winding. The magnetizing current is required to take the core through the alternating cycles of flux at the rate determined by system frequency. In doing so, energy is absorbed. Core-losses are present whenever the transformer is energized.

Transformer load losses occur because of current flow in an electrical system and depend on the magnitude of that current. Load losses are caused by the windings in the transformer, and are only present when loaded. The magnitude of losses is proportional to the load squared. The three categories of load losses that occur in transformers are:

- Resistive losses - often referred to as I2R losses.
- Eddy-current losses due to the alternating leakage fluxes

Energy Savings & Loss Reduction Opportunities

continues from pg 23

- Stray losses in leads, core-framework and tank due to the action of load-dependent stray alternating fluxes.

LINE LOSSES

In addition to skin-effect and proximity-effect losses discussed on the first page, cables also exhibit the same I2R resistive/heating losses reviewed in the Transformer section above and dielectric losses.

However, for single conductor cables, where conductors are not operating close to each other, proximity effect can be considered to be negligible.

Operating together in a typical industrial conduit-enclosed distribution system, these various line loss factors can sufficiently increase the facility electrical distribution wiring's apparent AC resistance to more than an order of magnitude above nominal DC resistance values. As a result, typical I2R wiring losses are often far greater than simple chart-based values. With the above, recall that I2R losses occur in ALL distribution system conducting components, not only the cable.

EDDY-CURRENT LOSSES

Flux will flow in any electrical system component comprising an iron or steel frame and an electrical coil as a result of the alternating current in the coil. The flux in the steel will itself induce an EMF in the material following the basic laws of induction. Since the material is essentially an electrical circuit itself, the induced EMF will cause a circulating electrical current called an eddy-current. Its total magnitude is dependent on the value of EMF and on the resistivity of the current path. As in any other electrical circuit, the losses can be calculated as the square of the current times the resistance. In a similar manner to hysteresis losses, the eddy-current loss manifests itself as heat, and contributes to the maximum operating temperature limit of the device. Eddy current losses occur in protective circuit breakers, lighting ballasts, power supply transformers, magnetic motor starters, voltage reduction or isolation transformers, current overload relays, control contactors and relays, and motor windings. They can also exist in facility wiring if it is in proximity to steel or iron structures such as electrical enclosures, distribution panels, or terminal or distribution blocks.

SUMMARY

As evidenced throughout this document, necessary components of an electrical system are contributors to energy losses in any facility. Measures can be taken to reduce current and harmonics in many facilities that will help minimize distribution losses and save energy. I2R heating losses in many facilities contribute from 1 - 3% of a facility's overall kW usage. Hysteresis and skin-effect losses are greatly impacted by current harmonics, and in facilities with high harmonic content, can add 1 – 5% to overall facility kW usage. Overall, employing devices such as real-time harmonic and reactive power compensation systems can help a facility reduce their energy consumption.

Further, real-time systems help a facility achieve:

- Improved voltage stability
- Reduced Power Factor penalties (if any)
- Reduced kVA demand charges
- Increased production thru-put
- Lower overall maintenance costs
- Reduced electrical-related down-time
- Improved utilization of electrical infrastructure

USEFUL FORMULAS

1) Loss Reduction:

$$\%Loss = 100 * \left[1 - \left(\frac{P.F.old}{P.F.new} \right)^2 \right]$$

$$\Delta P = (1 - \%\Delta V)^2 \Leftrightarrow P = \frac{V^2}{R}$$

2) Transformer Losses:

$$P_{LL} = P + P_{EC} + P_{OSL}$$

3) Eddy Current Losses:

$$P_{EC} = P_{EC-R} \sum_{h=1}^{h_{max}} \left[\frac{I_h}{I_R} \right]^2 * h^2$$

$$P_{EC-R} = RatedEddy - CurrentLoss$$

Article courtesy of Wayne Bromfield of Impact Energy. wn

TIS Training

Current Courses Offered:

- LV Cables Jointing and Terminating
- MV XLPE Jointing and Terminating
- MV PILC Jointing and Terminating
- MV XLPE & PILC Install, Joint and Terminate
- ABC LV & MV Installation, Joint and Terminate
- AMPACT Connector Installation
- ORHVS Responsible Person & Authorised Persons
- Cable Diagnostics & Fault Location
- Screened Elbows XLPE & PILC
- HV Cable Accessories 44-72kV H/S
- Cable Laying
- Accessories - MV Cable Jointing and Terminating
  (for Engineers, Technicians & Consultants)

TIS Energy

TIS aims to build sustainable relationships with our customers, by providing outstanding service, Superior quality products and skilled staff for diverse solutions. We do this by integrating a broad level of expertise, world-class products and training.

TIS provides training in accordance to Eseta requirements. The training consists of detailed theoretical and practical training. All trainees are individually assessed on theory and practical skills and the course covers both XLPE cable and PILC cable designs. Emphasis is placed on certain aspects of cable preparation and handling such as cross linking, stress, tracking and erosion as well as field experiences.

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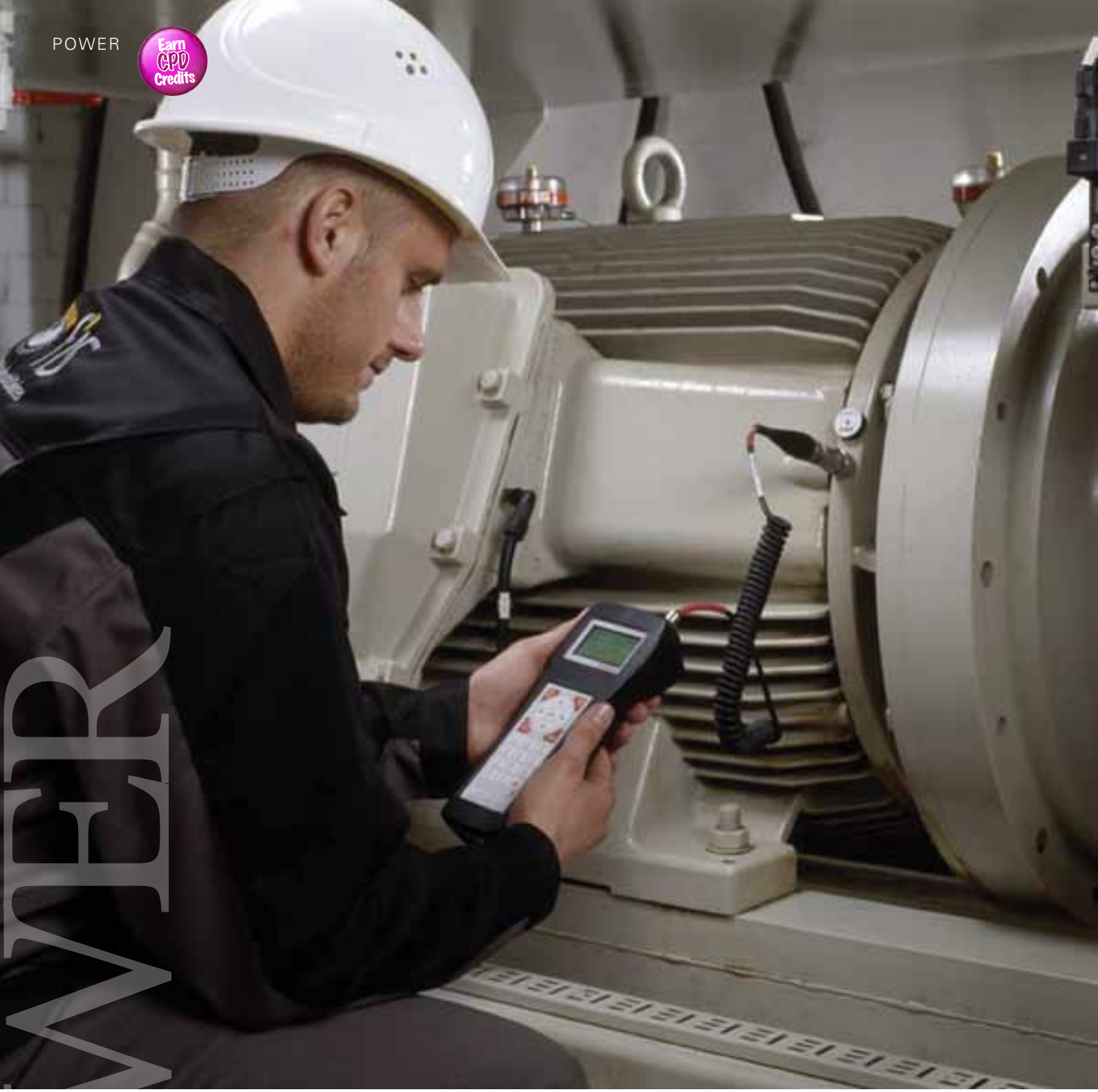

Condition Monitoring of Distribution Equipment

BY | MIKE CARY | PR ENG

The promise of light aside, there remain several other factors which impacted on the need for upkeep, refurbishment and maintenance:

- he availability of equipment has become paramount in today's society because of the dependence on electricity for business and home life. The black-outs in 2008 were a good illustration of this.
- Modern equipment manufacturers face much competition, which forces prices down. With the aid of powerful computers, new equipment is designed at the lowest cost to only meet the specifications, often removing any factors of safety that wer previously inherent in the equipment.
- Fault levels have increased subsequent to the Installation of equipment due to the system growing over time.
- Faults therefore are more likely to destroy the equipment.
- The cost of replacing equipment is extremely high.

DEVELOPMENT OF MAINTENANCE

The field of maintenance has evolved in its focus and application over the years. This shift stems from the growing sophistication of technologies, equipment. and techniques.

The focus of maintenance has been modified from a Repair Approach, to a Time-based Approach and finally to Condition-based Approach.

In short each approach can be defined as follows:

> Repair Approach:
Fix it when it breaks

> Time-based Approach:
Maintain at fixed intervals.

> Condition-based Approach:
There is no right time to maintain
Maintain as determined scientifically by monitoring the duties and condition of the equipment.

BUT WHY THE SHIFT TO CONDITION MONITORING?

The need for Condition Monitoring became apparent for the following reasons:

- To realise the inherent safety and reliability of equipment
- To minimise the cost of actual and potential failures e.g. the cost of injury or loss of life
- Economic cost consequences. This includes lost production as well as repair costs.
- Repair and maintenance cost - labour, materials, equipment such as cranes and traveling. A rule of thumb dictates that detecting and repairing a fault before it happens will cost one economic unit, as opposed to site repair (when possible) at 10 economic units, and workshop repair at 100 economic units.
- To determine what action needs to be undertaken e.g. to restore equipment to the inherent levels of safety arid reliability
- To take action to rectify potential failures
    - Rework - e.g. to re-install mechanisms correctly
    - Overhaul- e.g. to replace gaskets, dry - out of transformers
    - Discard - replace components e.g. switchgear contacts

These areas can have both short-term and long-term implications on the condition of the plant. A case in point is the immediate short-term risks of

The upkeep, refurbishment and maintenance of power plant and equipment play an ever-growing role in the power industry. This role assumed even greater prominence within the context of electrification of areas hitherto left in the darkness.

Condition Monitoring of Distribution Equipment

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failure linked to lightning faults. It may be, however, that the plant does not fail in the short-term, but that the lightning causes structural damage, which only becomes evident in the longer term.

Condition Monitoring adopts an approach that favours low capital intensive routine tests and monitoring of the plant condition for effective plant care rather than expensive maintenance and repair operations. By implication, therefore, routine maintenance activities may not always be necessary, or the best alternative for the plant. The latter is particularly true considering the impact any such intervention on equipment has on its life expectancy.

Some examples of Condition Monitoring interventions and their value are detailed below. This list is far from exhaustive, and with the rapid development of electronic measuring equipment, the techniques are becoming more accurate, and additional measurements are possible, including real-time on-line monitoring.

SUB-STATIONS

➢ INFRARED SCANNING

Infrared scanning is a method of scanning the entire sub- station for any excessive heat which can be generated by loose connections, equipment on the verge of failure etc.

Heat is one of the primary indicators of any defects within the plant. Armed with the latest technology in scanning, one is able to detect potential problem areas well before they have taken root.

➢ VIBRATION MONITORING

By means of sensors, the vibration of the power plant can be detected, indicating any irregular and excessive movements. Vibration monitoring is primarily used on reactors. A secure clamping arrangement is of paramount importance. Any excessive vibration, usually caused by looseness of windings, is highlighted by means of this method.

TRANSFORMERS

➢ OIL SAMPLING

Oil sampling is a procedure where oil is taken from the transformer and an analysis is done to detect moisture and hydra carbon gas content within the transformer. Ageing is also detected by means of Furfuraldehydes Measurement (degree of Polymerisation of the paper based insulation).

Although sampling is one of the oldest techniques for monitoring the condition of a transformer, it remains one of the most comprehensive means of obtaining data regarding the transformer, provided it is executed correctly. It is essential that careful attention be given to routine samples, ensuring thereby that any potential problem areas are identified well in advance of the occurrence of a failure.

➢ INSULATION SAMPLING

Similar to oil sampling, insulation sampling provides information regarding the water content in the transformer. Apart from this, it also offers insight info the condition and age of the insulation.

The age and quality of insulation is a clear indicator of the projected life expectancy of a transformer. These aspects are often the central determinants when maintenance or repairs are under consideration.

➢ RECOVERY VOLT METER (R.V.M)

R. V. M determines the moisture in transformer insulation.

This method is carried out off line and is less expensive than taking an insulation sample from a transformer when such a unit is still in operation and oil-filled.

➢ FREQUENCY RESPONSE ANALYSIS [F.R.A]

This method determines serviceability of transformers after through faults.

The low voltage impulse test method takes a frequency dependent characteristic response signature of a transformer. Any change in this signature can be used to detect winding movement caused by through faults or winding clamping arrangements not being correct. This technique has been found to be effective in defecting loose windings, after several transformers were tested before and after re-clamping. F.R.A, if carried out correctly, is an excellent tool to determine serviceability of transformers, especially if one considers how difficult it is to detect mechanical winding movement. Ideally, the initial signature should be taken in the factory of origin.

➢ PARTIAL DISCHARGE TESTING AND ULTRASONIC CENSORING

Ultrasonic censoring is a means of detecting electrical discharge or partial discharge from transformers. Measurement of partial discharge in HV substations is a very complex procedure as it occurs sporadically and requires specific site conditions for tests to be done accurately. Radio frequency noise may distort the results obtained. Partial

discharge can be measured through the bushing tap terminal or through the star point connection of the transformer.

Ultrasonic censoring has gained prominence globally as a means of testing partial discharge. It is a very promising method of measurement as partial discharge can be heard by means of the ultrasonic instrumentation.

SWITCHGEAR

This involves the testing of switchgear both on-line and off to detect any departure from prescribed operational specifications.

By applying Condition Monitoring and performing diagnostic evaluations of results, maintenance budgets can effectively be applied to switchgear in need of attention only and not wasted on equipment not in need of maintenance.

- **SF 6 GAS ANALYSIS**

This involves sampling of SF6 gas to determine the condition of the gas.

Similar to oil sampling, tests are conducted, largely on Switchgear (Breakers), in order to detect any impurities such as moisture, air, or decomposition products in the gas. Early detection of contaminated SF6 gas could lead to a considerable extension of component lifetime should action be taken timeously.

Drawing on a host of testing methodologies (some as well known as oil sampling and other more novel methods such as infra-red scanning or ultrasonic censoring), informed decisions can be made regarding corrective measures for your equipment. Thus, Condition Monitoring has rapidly forged itself as the "eliminator" of unnecessary activities, ensuring timeous execution only of the necessary.

To fully understand the value of Condition Monitoring, it is necessary to understand equipment failures and the prevention thereof.

There are basically three areas that impact on the condition of the power plant:

- **INHERENT DEFECTS OF THE PLANT ITSELF**

This may include certain vulnerabilities of the plant in terms of construction or design, such as poor design, incorrect application of materials and the unpredictable element of poor workmanship.

- **THE POWER SYSTEM TO WHICH THE EQUIPMENT IS COUPLED**

This involves the entire environment; including aspects such as whether it is coupled in parallel, over voltage conditions, transients and system fault levels. The lack of sufficient lightning protection also contributes to poor plant condition.

- **THE OPERATING CONDITIONS THAT THE PLANT IS SUBJECTED TO**

The manner in which equipment is operated:

- Transformers
  - Elevated loading
  - Operating Temperature
  - Through Faults
- Switchgear
  - Ambient Temperature
  - Switching Duty

CONCLUSION

Condition Monitoring and the host of other techniques available require highly specialised skills, and we are currently facing the threat of a rapid decline in such skills. In addition, people increasingly seek to specialise in softer skill areas at universities. However, on the plus side, the use of these techniques could be a good tool to assist the less experienced person in this field. wn

Earn CPD Credits

The South African Weather Service Lightning Climatology

BY I MORNE GIJBEN

Lightning is a product of severe weather and is frequently associated with large hail and heavy rainfall. Lightning on its own is also a deadly phenomenon that can lead to the loss of human life, damage to electrical infrastructures and various other hazards (Lynn & Yair, 2010). South Africa is a lightning prone country. Although the country doesn't experience as much lightning activity as regions like the equatorial parts of Africa and South America (Gijben, 2012), it still records some of the highest lightning strikes per square kilometre in the world (BusinessDay, 2012).

In South Africa, on average, between 1.5 and 8.8 lightning related deaths per million of the population occur each year (Jandrell et al., 2009). Insurance claims are said to amount to more than R500m per annum (Gill, 2008) and the Climate Information Section at the South African Weather Service (SAWS) reported that most of its insurance queries were lightning related.

The major power utility in South Africa, Eskom, which is one of the main users of data from the South African Weather Service Lightning Detection Network, reported that the utility spent millions of rands each year to replace infrastructure damaged by lightning (BusinessDay, 2012). These statistics clearly show the need for a lightning detection network and in turn the development of a lightning climatology to determine the area's most at risk from lightning in South Africa.

The South African Weather Service Lightning Climatology

continues from pg 31

THE SOUTHERN AFRICAN LIGHTNING DETECTION NETWORK

Prior to 2005 the only significant lightning detection network in South Africa was the flash counter network, which was operated by the Council for Scientific and Industrial Research up to the early 1990's. This network, which measured only lightning flashes, was not as technologically advanced as present day lightning detection networks and had a relatively short range which meant that some flashes which occurred between sensors were not detected. Data from this network was also used to create the first lightning flash density map of South Africa, which up to recently was used as the primary lightning distribution map for various disciplines (Gijben, 2012).

In 2005 SAWS made a large capital investment by purchasing a lightning detection network from Vaisala, which consisted of 19 LS7000 sensors distributed throughout the country. These sensors are designed to measure cloud-to-ground lightning by using magnetic direction finding and time of arrival methods to determine the position of a lightning stroke (Gill, 2008). More recently additional sensors were added to the network and some of the old sensors were relocated to new positions. This upgraded network, called the Southern African Lightning Detection Network (SALDN), now consists of 23 sensors in South Africa and one sensor in Lesotho to make up a 24-sensor network. Most areas of South Africa comply with the minimum requirement of detecting at least 90% of all lightning strokes and placing each stroke within at most 0.5 kilometres from the actual stoke position (Gijben, 2012). This network has now recorded data for just over 6 years.

LIGHTNING CLIMATOLOGY

The SAWS lightning climatology is compiled from SALDN data recorded for the 6-year period 2006-2011. This climatology is created on a 0.10 x 0.10 grid and to follow international convention was compiled by only considering lightning flashes. This climatology comprises lightning ground flash density, median peak kilo ampere and average flash multiplicity maps which were created for all lightning flashes irrespective of the polarity (positive and negative flashes) and also just for positive flashes.

A percentage positive map was also created. The above-mentioned maps were used to create three proposed lightning risk maps. In this article only the lightning ground flash density map for all lightning flashes as well as the three risk maps will be discussed.

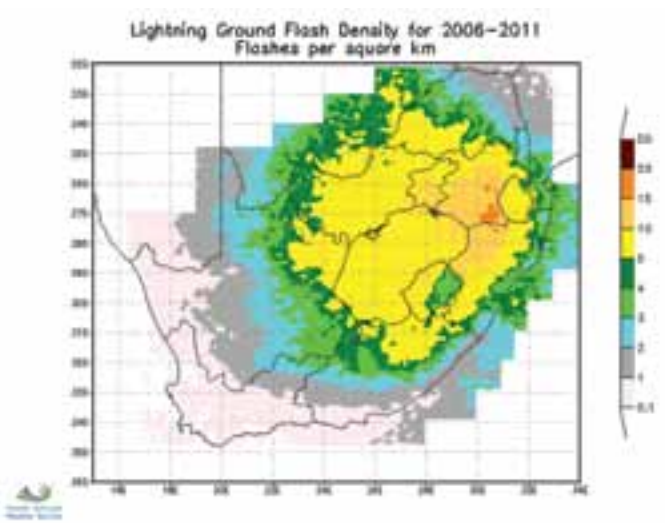

Figure 1: *A map showing the lightning ground flash density for the six-year period between 2006-2011 (Source: South African Weather Service)*

LIGHTNING GROUND FLASH DENSITY

The lightning ground flash density map is the most widely used lightning climatology map in the world. This map shows the distribution of lightning by giving the amount of lightning flashes per square kilometre per year (Gijben, 2012). Figure 1 depicts the lightning ground flash density map. The highest flash densities, of more than 15 flashes/km^2, are found along the windward slopes of the Northern Drakensberg Mountains. These flash densities are seen in the northernmost parts of KwaZulu-Natal and the Mpumalanga Lowveld. The western to north-western parts of Kwazulu-Natal, the Mpumalanga Lowveld, southern parts of Gauteng, northern and north-eastern Free State and small areas over the western parts of the North West Province can see flash densities of between 10 and 15 flashes/km^2. A large part of the central interior of the country receives flash densities of between 5 and 10 flashes/km^2. Flash densities decrease towards the northern to north-eastern parts of the country, towards the east and also towards the western parts. The Western Cape is the province with the lowest ground flash densities.

LIGHTNING INTENSITY RISK

The lightning intensity risk map is proposed to give an indication of areas at risk from high volumes of lightning (Gill, 2008). It is a single map that combines the lightning ground flash density, median peak kilo ampere and average flash multiplicity map into a single map to identify those areas where lightning frequently occurs, where the current in the lightning flash is high and where a large amount of strokes occur. The output of this map identifies the risk of an area, which ranges from low risk to extreme risk.

As one moves towards the northern parts of the country, towards the southern and eastern coast, and also towards the western parts of the country the risk decreases.

Figure 2 displays the lightning intensity risk map. Areas along the windward slopes of the Northern Drakensberg Mountains fall within the extreme risk category while a large part of the central interior of the country is at severe risk from lightning. As one moves towards the northern parts of the country, towards the southern and eastern coast, and also towards the western parts of the country the risk decreases. The Western Cape is mostly a low risk area.

POSITIVE LIGHTNING RISK

Since lightning with positive polarity is frequently considered to be the most destructive form of lightning (Rakov & Uman, 2006), a risk map called the positive lightning risk map was developed. This risk map considers the positive lightning ground flash density, positive median peak kilo ampere, average positive multiplicity and percentage positive map. This risk map can thus be used to identify those areas at risk from lightning with positive polarity.

The positive lightning risk map can be seen in Figure 3. A significant feature of this map is that most of the country can be considered to be at severe risk from lightning with positive polarity. The central part of the country is at the most severe risk while the rest of the areas falling in the severe risk category fall within the lower end of this category. Some parts over the central to north-western and northern parts of the Northern Cape, northern parts of the Limpopo Province, eastern-most parts of Mpumalanga, areas along the coast of KwaZulu-Natal and the Eastern Cape and a small area over the Western Cape are at moderate risk from lightning with positive polarity. The west coast of the Northern Cape is mostly at minimal risk while some areas of the Western Cape are also at minimal risk. A large part of the Western Cape is at low risk from positive lightning.

TOTAL LIGHTNING RISK

The final risk map, called the total lightning risk, was designed to give a general purpose risk map to take into account the areas at risk from high volumes of lightning as well as the areas at risk from lightning with positive polarity (Gijben, 2012). This risk map simply combines the lightning intensity risk map and positive lightning risk map into one single map.

Figure 4 shows the total lightning risk map. The central to northern interior of the country is at extreme risk while most of the remaining parts of the country fall in the severe risk category. The risk decreases towards the west of the country with areas along the western parts of the Northern Cape, the Western Cape and the southernmost parts of

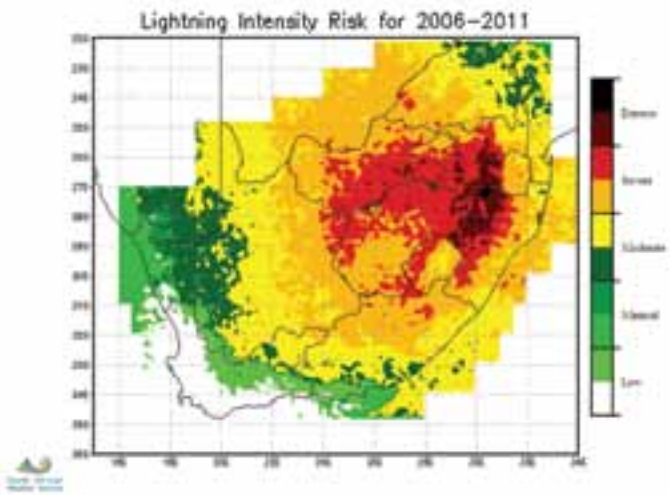

Figure 2: A map depicting the lightning intensity risk for the six-year period between 2006-2011 (Source: South African Weather Service)

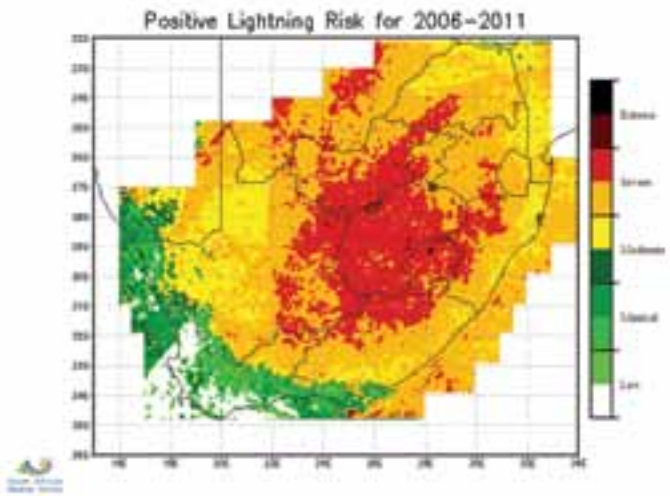

Figure 3: A map showing the positive lightning risk for the six-year period between 2006-2011 (Source: South African Weather Service)

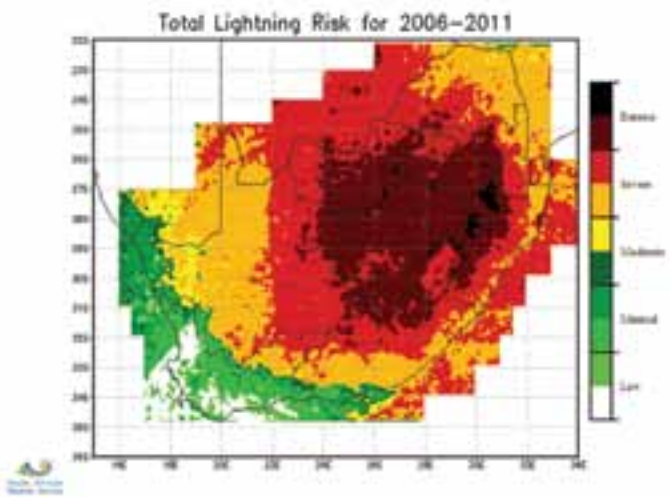

Figure 4: A total lightning risk map for the six-year period between 2006-2011 (Source: South African Weather Service)

The South African Weather Service Lightning Climatology

continues from pg 33

the Eastern Cape experience low to moderate lightning risk. The Western Cape is the region in South Africa with the lowest risk, with most of the province falling inside this category.

CONCLUSION

The most significant outcome of this work is that South Africa now has a lightning climatology based on data from the state-of-the-art SALDN for a six-year period. These maps can now be used throughout South Africa for various disciplines.

This includes, amongst others, setting lightning safety standards, identifying high lightning risk areas for lightning safety, determining the areas where lightning is most likely to interrupt power supplies, insurance companies can identify high risk areas, areas at risk from lightning induced fires can be identified, and various other institutions may benefit from these maps.

The risk maps that were developed are a novel way of combining different lightning parameters into a single map that can be used to determine the total risk. These risk maps are also easily modifiable for individual needs. wn

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Lightning is an extremely complex phenomenon and understanding the effects thereof requires knowledge and expertise involving a variety of divergent disciplines - including those of climatology, engineering and medicine, to name but a few. In order to make substantial progress in our understanding of the effects of lightning, it is essential that a more integrated and multidisciplinary approach now be followed when conducting research into this fascinating field.

Forensic pathology is the study of the diseases and injuries of the community. Keraunopathology is the study of the pathology of trauma of lightning. Very little has actually been written about keraunopathology in forensic pathology textbooks, with only a page or two dedicated to the subject in much of the classic texts. Much of what has been written constitutes myth and has been passed down from mentor to student without having been critically thought about. In fact, much of the field of keraunopathology has yet to be scientifically verified.

The study of lightning and its effects on human and animal survivors is known as keraunomedicine, which is a rapidly developing field, with substantial representation at international conferences on lightning research, trauma and clinical forensic medicine.

It has been estimated that there are approximately up to 100 lightning related human fatalities annually in South Africa. Based on international data, it is likely that there will be at least four or five times that many survivors of lightning strike, presenting for clinical treatment.

Five mechanisms have been described in the literature regarding lightning injury mechanisms. Recently, a possible sixth mechanism of lightning injury, namely lightning explosive barotrauma, was described. An experiment was published demonstrating the significant concussive blast wave effect immediately surrounding lightning's luminous channel, in the American Journal of Forensic Medicine and Pathology. The existence of the sixth mechanism of lightning injury can now possibly help explain some of the rare and more curious lightning injury patterns.

One such curious lightning injury pattern was recently described in a case report in the same journal, in which a 48 year-old-female was struck dead by lightning in Pretoria South Africa. Examination showed secondary missile injury on her legs. This secondary missile (shrapnel) injury was caused by the lightning striking and exploding the concrete pavement next to her. Small pieces of exploded concrete were located lodged and embedded within the shrapnel wounds. This case report represented the first documented case of secondary missile formation (shrapnel injury) due to lightning strike in the literature.

Therefore, the role of the forensic pathologist in such a case would be the following:

- To help determine the time of death.
- To help determine the cause and manner of death.
- To help determine the mechanism of injury (in other words the mechanism of lightning attachment).

The Complexities of Lightning

Lightning poses a risk to humans, animals, plants and industrial systems. Its damaging characteristics are primarily due to the immense potential differences and electric currents that are generated.

BY I RYAN BLUMENTHAL

- To help determine the mechanism of death (for example cardiac-arrest, neurogenic arrest, etc).
- To help identify the deceased if unknown.
- To help collect evidence from the body.
- To help document injuries or lack of them.
- To help deduce how the injuries occurred.
- To help document any underlying natural disease.
- To help determine or exclude other causes of death.
- And to help provide expert testimony, if required to do so.

For example, the South African Weather Services could help confirm lightning strike at the time of death.

The electrical engineer could help geo-locate the precise location of the fatal lightning strike. The scene investigator could help determine whether or not there were any signs of lightning damage at the scene.

The multi-disciplinary approach is therefore paramount in the collation of a lightning fatality case from a forensic point of view.

The forensic pathologist will always be expected to answer why and what might have been done to prevent such needless deaths in the community. Ideally, these answers should feed directly back into society, specifically with regards to lightning safety and lightning protection. wn

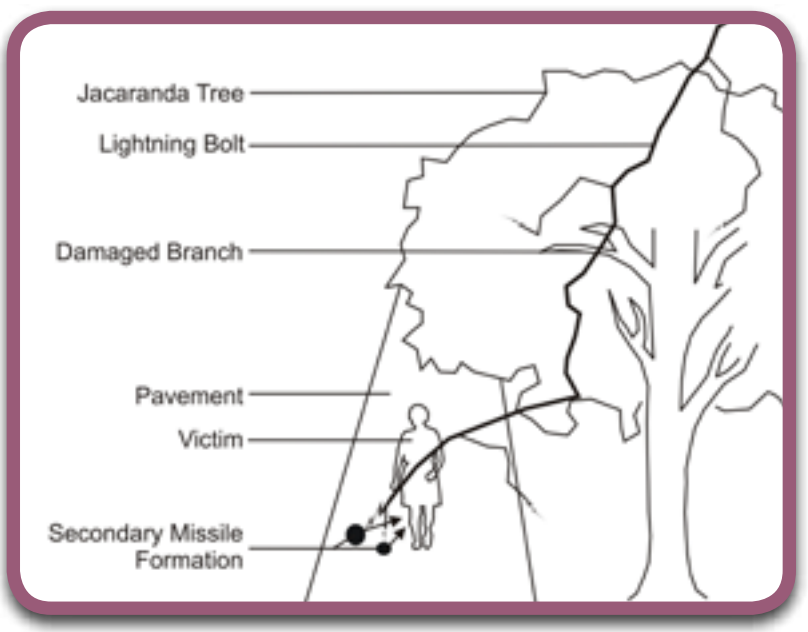


Figure 1: Shows a graphic representation of the lightning strike event in which a 48-year-old female was struck and killed by lightning.
This specific case report helped demonstrate the value and usefulness of the integrated and multidisciplinary approach.

Earn CPD Credits

Lightning photography is a subject of interest for photographic hobbyists, but a photograph of lightning can also provide us with significant information for scientific research purposes. The progression in the uses of lightning photography has provided researchers with information on lightning and its processes that are invisible to the naked eye. It has also provided a platform in understanding the physics behind some of these processes. Modern technologies have also produced additional tools for extracting information that can help in the practical challenges faced with the deleterious effects of lightning ground flashes.

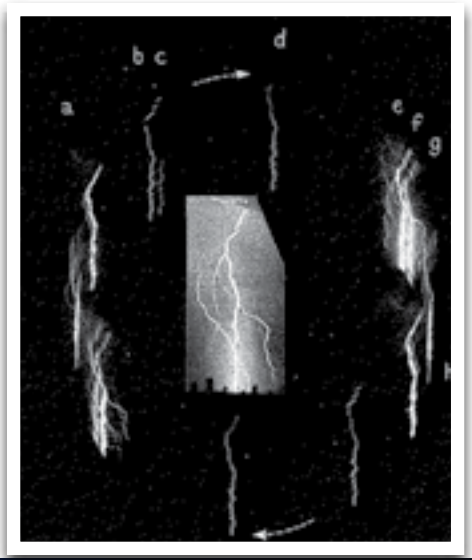
BY I VIC LIU

LIGHTNING PHOTOGRAPHY

Not just a pretty

The photography of lightning is not the simple task of "point and shoot". It has a short duration; the location and time of a lightning flash are unpredictable and the exact shape of any discharge channel is not repeatable. Capturing photographs of lightning requires preparation, luck and perseverance.

A safe vantage point is required that is dry, has little obstruction in the view and is properly shielded or electrically isolated. A triggering mechanism needs to be implemented with controllable shutter speeds or exposure times. If long-exposure shots are used, a steady camera stand must be available. Thunderstorms commonly occur at night-time, so photographing lightning can involve sleepless nights.



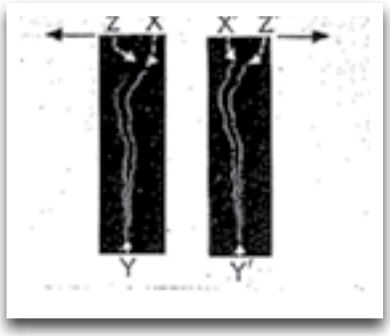


Fig 1 - Boys-camera picture of a lightning-flash, with fixed picture and pictures of stroke (d) mounted for measurement.

picture

© Jason Lanier Photography

Early researchers spent many years in the attempt to capture photographs of lightning. Nowadays, similar challenges still exist, but with the development of sophisticated recording and photographic equipment, some of the challenges can be minimised or even eliminated through automation. Due to the unpredictable nature of lightning, research is based on capturing evidence of actual occurrences through the use of electric field sensors, instrumentation on tall towers and optical recorders such as camera photography or video recording.

PHOTOGRAPHY THROUGH THE AGES

With the onset of SLR film photography, capturing lightning events on light-sensitive film was made possible with long exposures. In 1902, a British scientist named Sir Charles Boys devised a camera to photograph lightning in high speed. The hand-operated high speed camera is known as the Boys camera. The concept behind the Boys camera involved the rapid circular movement of an open lens over a fixed piece of film. The exposure to any part of the film was limited by the speed and motion of the lens. Using this method, the Boys camera allowed for microsecond time-resolutions on the photography of a single lightning flash. The fieldwork in the implementation of this camera was performed in South Africa, as thunderstorm seasons in South Africa are more active than in England. The recordings provided some of the earliest observations of the lightning propagation processes involved between the cloud and the ground, estimates of leader propagation speeds, and quantification of separate lightning strokes and stroke durations. (Fig 1)

Improvements in electronics allowed for streak cameras to be used in the application of recording lightning flashes. The images produced by streak cameras appear blurred, as though the camera has been moved linearly with an open exposure. The resulting image appears "streaked" and the length of the fading blur can be interpreted to the duration of time that the object is in view. Lightning photographs recorded using streak cameras can show the progression of a stepped leader propagating towards the ground, in one photograph that was easy to interpret. The use of streak cameras provided photographed lightning images that required less processing and more intuitive time-resolutions when compared to the Boys camera. (Fig 2)

In more recent years, a new recording medium for cameras was developed in the form of CCD (Charge-Coupled Device) image sensors used for digital photography. This digital format allowed for immediate gratification on photographed images and more efficient image storage. With the breakthrough in digital high-speed recorders, lightning and its processes could be observed as videos with frame rates between 1,000 – 50,000 fps (frames per second). This produced a series of time-resolved images; each individual frame containing snapshots of the stages in the lightning progression to ground. The use of digital high-speed recorders has combined the time-resolution advantages of the Boys and streak cameras with all the advantages of digital recording.

Further developments in recording equipment include surveillance

LIGHTNING PHOTOGRAPHY

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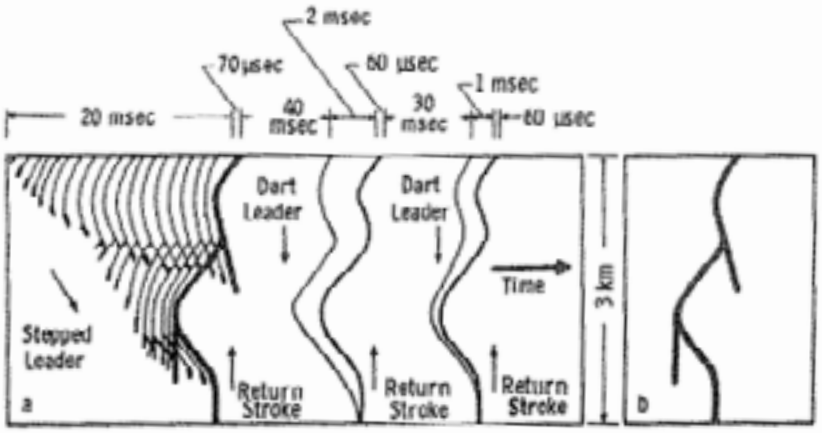
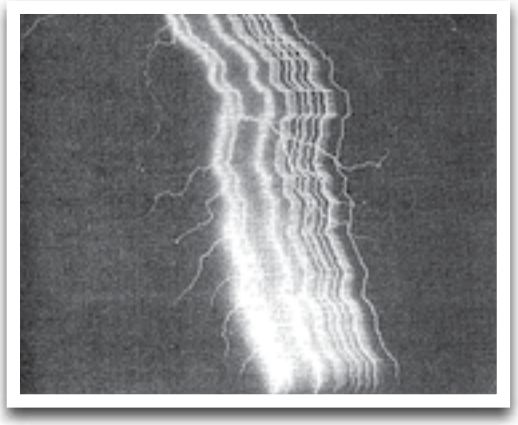


FIG 2 - (a) A drawing of the luminous features of a lightning flash below a 3-km cloud base as would be recorded by a streak camera. Increasing time is to the right. For clarity the time scale has even distorted. (b) The same lightning flash would be recorded by a camera with stationary film. Adapted from Uman (1969).



Streak-camera photograph of a 12-stroke lightning flash. The first stroke is on the left and is the only branched stroke. Increasing time goes from left to right. Continuing current, as evidenced by continuing luminosity, flows after the eleventh stroke. Photograph is of lightning near Socorro, New Mexico. Courtesy Marx Brook, New Mexico Institute of Mining and Technology.

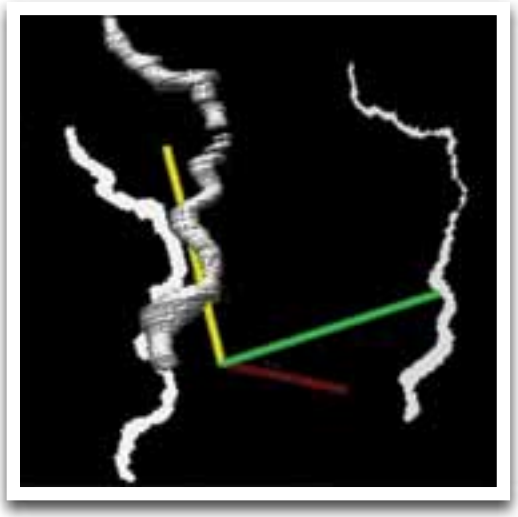


Fig 3 - 3D visualisation of lightning images.

Fig 4 - Common termination points images.

cameras. These cameras may not make sense for lightning photography, but allow for continuous, standard-speed monitoring at 30 fps and the automated recording of lightning events using motion detection technologies. Modern surveillance cameras have powerful capabilities that can be customised to user requirements. The use of these cameras has allowed for automated recording, and requires minimal user interface while monitoring a thunderstorm.

A NEW PERSPECTIVE

The lightning discharge channel contains no visible surface relief in light and dark contrast to produce information on the spatial extent of the flash. Therefore, it is difficult to perceive the channel shape of the complex path with a flat two-dimensional image. Two or three perspectives of a specific lightning flash can resolve this spatial limitation. The advancement of computer technologies and graphical capabilities has produced the opportunity to visualise the lightning discharge channel in three dimensions. Using visualisation techniques, a specific lightning event can be analysed using pan, tilt and zoom options in an interactive 3D environment. By understanding the spatial extent of a lightning flash and the influence that ground structures have on the progression of the lightning leaders extending from the clouds, a better understanding of safety and protection around lightning events can be established and fed back into society. (Fig 3)

The ground termination of a lightning flash is the primary concern for protection engineers. This is the location around which the deleterious effects of lightning are present. The photographic monitoring of lightning at a fixed point of view can help to identify common termination points over a selected period of time. In this way, unknown – but commonly struck – lightning termination areas over a skyline can be determined for a fixed perspective. The additional use of supporting Lightning Detection Network data matched with the photographed occurrences can help to provide an additional spatial perspective and potentially aid in identifying areas of highest lightning risk.(Fig 4)

CONCLUSION

The progression of photographic technologies have allowed for the further understanding of the lightning phenomenon, from the use of still photographs with light-sensitive film, to high speed digital recorders and automated surveillance cameras. In addition, visualising the three-dimensional spatial extent of lightning can be achieved with several camera perspectives and common lightning terminations can be determined for a fixed camera perspective to help identify areas of highest lightning risk. Through the scientific concept of visual observations and recording, lightning photographs have an important place in scientific and practical engineering applications. wn

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Reminiscences from an ISCOR "Appie"

By now, everybody knows that I fly the flag for artisans. I was lucky enough to go through an apprentice-training scheme and emerge as a qualified artisan. I also managed a university education. The reason for that was a rather large chip on my shoulder, but more about that later.

BY | GEOFF CARTER | PR TECH ENG | BSC HNDT MSAIEE

I arrived at the ISCOR training centre with a rather over inflated opinion of my worth to society. I had been to an academic school and was led to believe that we matrics were already the next generation forging ahead into the rough seas of the future, sweeping the whole of mankind behind us in an adoring mass.

On arrival at the appie training centre, I was handed a green overall and a pair of safety boots and told to report to Mr Mattys in D block. Aha! I though. At last! My training in the mysteries of electricity was about to begin. Remembering the pleasures of assembling HEATH KIT CRYSTAL SETS… (is there anybody outside of an old age home who remembers those?) ….I sashayed into the workshop of Mr Mattys, expecting 5 star tuition.

Once the handshakes and welcomes had been complete, and the personnel officer safely out of the way, Ronnie looked at me as if I was a piece of rat food and enquired what I thought I was doing in his workshop. While I stammered a reply, he led me towards a grey workbench under which resided a large wooden toolbox. The toolbox contents and I were to enjoy a long and somewhat pained relationship for the next year.

He opened the toolbox and pointed to a set of... files. With a malicious gleam in his eyes, he handed me a ball from a bearing and a drawing. The drawing showed a gambling dice in first angle projection. "File me a dice...", he politely requested. "But I am not a mechanical appie", I protested. He handed me a second ball with a request for two dice to be produced. Being a matric, I shut my trap and turned in despair to the vice attached to the workbench. I tried, but could see nothing electrical about the contraption. The other appies in the workshop looked at me as if I was a condemned man on a trapdoor.

I spent the next month filing those two bloody dice. They were perfect in every way. Engineering blue was used to ensure that it was square and to micrometer size. And they were!

I still have them. The next thing I filed was a BENCH VICE! You read correctly. A BENCH VICE! Entirely made by hand except the spindle. I made an instrument vice, a drill clamp, a G clamp, a scriber, a drill gauge, and a centre punch. All by hand. Which brought me to the end of a very pleasantly spent nine months!

I still have all of these items wrapped in plastic and carefully oiled. I am very proud of them even now. Needless to say, I can cut a railway line with a hacksaw, to very close tolerances.

What a lot of useless skills you might think.

I don't know if any of you have ever tried to file a ball bearing. It is as hard as glass. One morning, I was feeling particularly aggrieved at my lot and moaned and complained to Ronnie Mattys about not wanting to be a mechanical appie…I mean electrical millwrights were the cream of the crop were they not??

His answer was simple. "When I think you are ready and have the ability to pay attention to detail, I will allow you to work on an electrical circuit."

Man was I hacked off.

But over the years, I have come to respect the wisdom of those words. I have also come to respect and appreciate the men who taught us as appies. Many of them were artists. They cared about us and taught us well. They also slapped us around the ear every once in a while to keep us honest. I particularly remember one artisan who was an ex member of the WAFFEN SS. He was also an outstanding hydraulics technician and taught me a number of things worth knowing.

I was only allowed to progress to the next level of responsibility when I had mastered the last one. I can remember when, at the tender age of 22, I was the shift millwright in charge of a night shift on one of the large ISCOR mills. I was still an appie but the artisans, who should have been on shift, and for whom I worked, were off ill. The foreman told me to get on with it and phone if anything happened. I did not sleep once during the night. I promise you! If I had phoned him, I'm sure I would not have been here to recount the incident. He was a large loveable man who had on occasion shared his two-inch thick polony sandwiches with me. I always ate them. He was also capable of bending the handle of a 14-inch "bobbejaan" spanner. I had seen him do it.

The point is, there was nothing that gave me the right to move to the next level of responsibility except my own ability and training.

If you did not progress at the required rate, you could be sure of an invitation to visit Mr Wolfgang Boesenberg and explain why he should not suspend you from work. Trust me, I still have nightmares about that.

And that is the way it should be. Having qualified people in charge of your training and who know what is required of a good artisan is essential.

It is not just about the diploma and the money. It is about knowing the consequences of your actions and your workmate having confidence in knowing that you are not going to kill or injure him with a stupid action. If the wrong switch at the wrong time is operated, one cannot just rub the mistake out and try again.

If a youngster is worth investing time and money in, then lets entrust his training to people who know what they are doing. And besides, we have lots of old ball bearings that need to be turned into dice. There are many older artisans out there that I know of, who would make excellent teachers. Let them teach the kids! wn

And slap the odd ear now and then.

iscor appie

This article discusses that whilst some of the reasons stated above may be contributing factors, the key area which has pushed the skills challenges even further has been the failure to integrate efforts on skills development for various industry sectors with the training and exposure at schools level. That is basically to say that industries should take active roles themselves and to use surrounding communities as strategic resource pools for human capital. Undoubtedly the glue to the industry initiative has to be strong support from government in various tactical forms and shapes.

At schools levels, learners' ambitions become misguided because industry is inactive in enlightening them in order to feed companies' own skills base in a not so distant future.

CURRENT EFFORTS IN SKILLS DEVELOPMENT INITIATIVES

The SETA's

The SETA (Sector Education and Training Authority) was established by government to develop skills for each sector with the purpose of getting trained/skilled employees absorbed by the sector at the end of the training program. The industries within the various sectors contribute financially with the expectation of suitably trained employees being delivered.

Learnerships

A learnership is a government initiated learning program with organized learning initiatives/program aimed at providing experiential on–the-job learning which in turn gives the learner the necessary qualification for the occupations for which he/she was trained.

Learnerships are linked to companies with employment and with learnership agreements that are linked to non-binding permanent contracts of employment.

Company based skills development

Most companies have developed their own programs for internal


Photo courtesy of energyforopportunity.org

DIGGING DEEP

AN INTEGRATED APPROACH TO SKILLS DEVELOPMENT IN SOUTH AFRICA

BY I NHLANHLA MAPHALALA

During the last decade South Africa has been challenged by a skills shortage in the fields of science, technology, engineering and more recently commerce. Contributing factors include emigration of skilled professionals, lack of interest in technical careers, closing of technical colleges, non-functionality of FET (Further Education and Training) colleges, low starting salaries paid to technical employees, perceived non-sexy/classy jobs and technical experts changing to non-technical careers.

skills development, which includes embarking on the learnership route, or coaching and mentorship programs that will develop a pool of skills for the sustainability of the company.

This is done either to finally ensure employment or to provide learners with skills and avail them to other companies for potential employment

A. Vermaak in his article "Strategic approach to skills development and staff retention" raises the issue of contracting trainers and mentors to focus on just skills development and relieving management and staff of the burden of skills development.
According to the author's experience during years of working for Sasol as an example, Sasol's skills development model involved the assigning of a technical coach to graduate engineers and a mentor (personal guardian) of the graduate's choice. A technical coach managed the program and the trainee included rotation to various Sasol Business units in the relevant disciplines for training and general exposure to the business and processes.

The coach is responsible for assessing the acquired knowledge and making sure the rotation as per the training program takes place. This process takes at least 18 to 24 months before the graduate is promoted to mainstream engineer, scientist or technician.

It has been observed that in other companies, skills development is driven and managed by the human resource (HR) department. Once a program is completed operations and/or maintenance departments that express interest in the trainee or through a recommendation/notification made by HR, the trainee is ready to be absorbed or released to the relevant department(s).

CHALLENGES WITH THE CURRENT APPROACHES TO SKILLS DEVELOPMENT EFFORTS

The fact that the SETA's are unable to release their trained graduates straight into industry and with an industry that seems to lack confidence in SETA trained skills, it remains a challenge to comprehend the role and significance of the SETA's. Furthermore, in case of employment by a company there still exists a need to induct and adapt new employees to the culture and policies of the company.

DIGGING DEEP

continues from pg 45

Whilst it seems that learnerships have better intentions, their challenge is unguaranteed jobs and also the possibility of exploitation of this initiative for cheap labour purposes and/or Government National Skills Levy.

There are still many company training models which are more of an arms-length type of approach to skills development instead of getting closer to trainees and making them part of the company and incorporating them into the main-stream of operations, unlike skills development with subcontracted mentors or coaches or led by HR.

The latter approaches break the link with potential colleagues and lead to management becoming even more distant from the direct and specific development and monitoring of the performance of graduates which they need to shape for the daily running of departments and strategic intent of the company.

THE CASE FOR INTEGRATED APPROACH

The general approach with the current efforts are that they mostly take effect once learners have completed matriculation, either in a form of providing a tertiary bursary and thereafter employ and train, or otherwise employ graduates after degree or diploma completion and then subsequent training.

With the late involvement of companies in skills development, it basically leaves the companies with further skills training and the need for exposure of graduates during their induction into the company. This exercise normally takes 2 to 3 years of training with a "non-recovering" resource.

The integrated approach by companies proposes a model where they expose their surrounding community learners to their operations as early as Grade 8 to build a long-term pipeline of loyal community based employees.

This involves each company taking a group of learners which will become "children of the company" using a set selection test based process. During early school grades, learners must be exposed to various departments in the company for at least 2 hours every day of the week after normal school hours.

Concerted efforts need to be made to ensure that all company employees have a duty to facilitate and manage the groups of learners that may visit their specific departments. This can be achieved through including this as part of employees' Key Performance Areas (KPA). This employees shall include learner assessment reports, in their achievements on departmental projects that they provide during their stay in the rotation cycle.

The scope of the learners' exposure with light (right level) skills development can include character shaping, problem analysis, presentation skills, communication, report writing, company policies, teamwork, company operations, different careers in the company and many more.

From grade 10 or 11 after completion of the departmental rotational cycle, learners should start making career choices based on their exposure in various departments. Departmental learner performance assessment should also help in gauging whether the career choice made is the correct one, or whether a need exists for channeling the learner into a career choice, which supplements her/his strengths or their specific preference.
Figure 1 summarizes the proposal.

This approach can stretch further to also providing ongoing support for learners, even after high schools education, in the form of a bursary as well as vacation work in the selected tertiary career being pursued.

BENEFITS

- Creation of a sense of purpose for learners.
- Building entrenched skills base for industry and country.
- Creating working relationship between schools, community and surrounding industry.
- Companies molding learners at early age for their pipeline resource purposes.
- Social investment and responsibility for companies.
- Ongoing assessment and selection for company bursary schemes.

INCENTIVES FOR COMPANIES

- Achievement or improved BBBEE scores (where this is used for that particular strategic intent).
- Possible tax break (when allowed by govt.) for companies.
- Close contact with future employees, nurturing/motivating and luring talent.
- Character molding and role modeling to be emphasized.
- Provide pipeline for future skilled resources.
- Opportunity for early relationship building between company and employees.
- Major savings on induction training budget and recruitment.
- Savings on recruiters or use of agents (HR overheads)
- Graduate employees that are ready to deliver from the first day at work.
- Development of own pipeline that has been nurtured internally by company thus can reasonably predict performance
- Being a good neighbour to your surrounding community

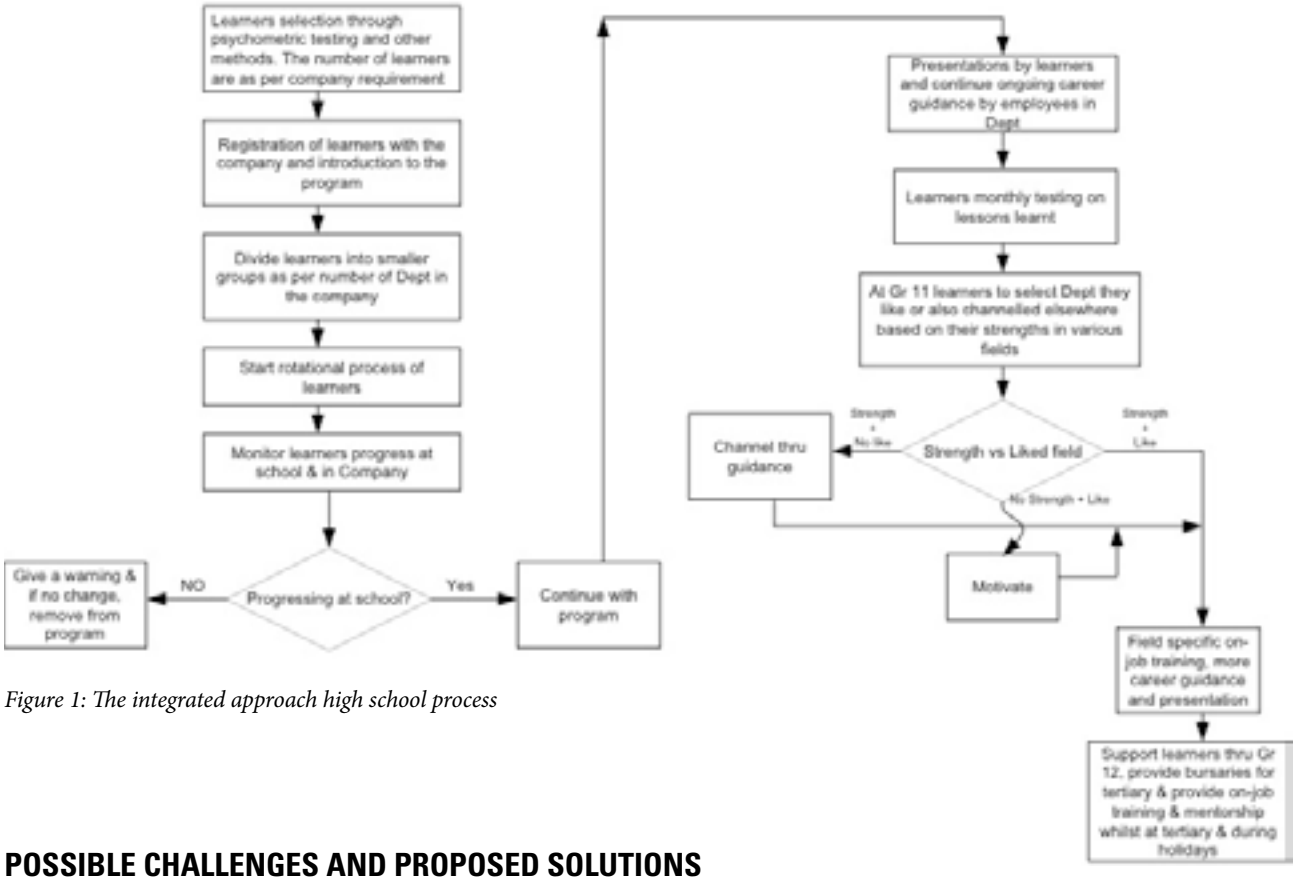


Figure 1: The integrated approach high school process

POSSIBLE CHALLENGES AND PROPOSED SOLUTIONS

Challenge	Solutions
1. Exploitation of learners	Protected by Constitution sections 28 & 38
2. Child labour as outlined in Constitution, Employment Act, Schools Act & Labour Law	The initiative is not employment but rather a new way of learning through practical training/education & skills development
3. Possible extension of school hours for learners with this training	Consent from parents and governing body to be negotiated
4. Safety of learners within companies	Learners to be supervised and not to take part or exposed to risky matters
5. Remuneration for learners may be seen as payment	This (if approved) will in no way be for training performed, rather a compensation for participation
6. Transportation of learners to the companies and back home	Companies to consider subsidizing the means for the learners to get to their companies.

CONCLUSION

In a country where fast development needs to be realized in order to solve a number of challenges that many of the developing countries are experiencing, all sectors have to work together as a unit. There is a great need for all to stand together and be counted in making meaningful contribution to realizing the future that we all aspire to see for South Africa. In future South Africa will have to have education as a significant element for improvement.

The integrated approach model will address areas where there are neighbouring industrial or commercial areas nearby the communities. In rural areas this approach will require special solutions like learners getting this exposure during school holidays and/or special visits by companies on a monthly basis. This will assist in getting a sufficient population of learners that are well developed and sufficiently groomed for the future.

Typical questions to the interested parties may now be, "so what is next?" Here are the actions required:

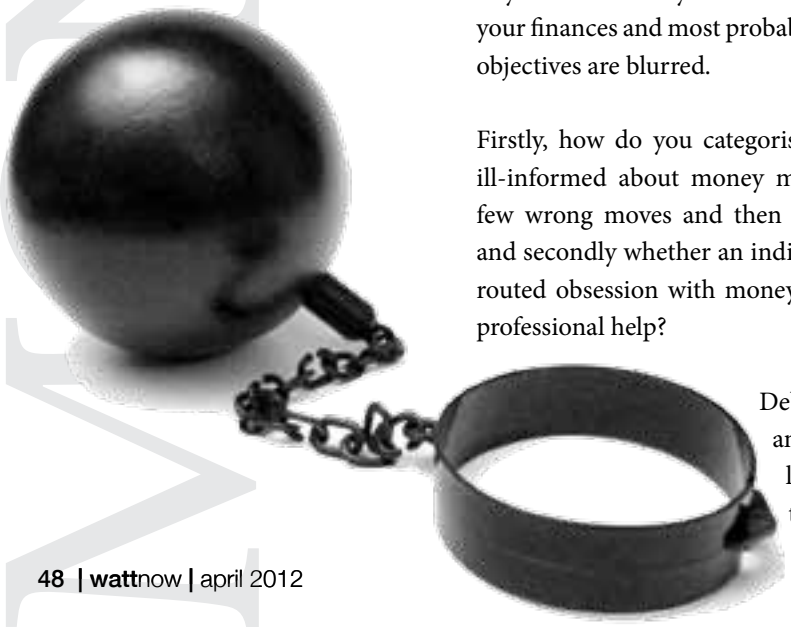
- Get government (Department of labour, education, and treasury) buy-in into the initiative.
- Create standard and inclusive selection criteria for nearby community school learners to be subjected into for the selection of learners to be part of the "babies of your company".
- Mobilise other nearby companies to do the same for this to be attractive and to be accepted nationwide.
- Create internal rules and guidelines on how your employees should participate and support learners like including training of learners as part of KPA.
- Speak to local authorities and unions for support and buy-in. wn

~ "WE ALL NEED TO HUG THE DEBT MONSTER OR IT WILL BITE US" ~

Avoid an abusive relationship with debt

BY I DENNIS FLEMMER I COUNSELING PSYCHOLOGIST

Debt is something that people needs to face at some stage of their lives. The problem is not the debt, but the way in which we react to it. DebtSafe employ an array of debt counselors who specialise in giving hope to individuals who are indebted, and they have consulted Counseling Psychologist, Dennis Flemmer to provide further insight on the relationship individuals have with Debt.



"There is an essential distinction between being 'in debt' and having a personal problem with money," says Flemmer. "Getting out of debt does not mean that you are going to stay out of debt. It also does not mean that if you have no debt that you are a responsible person. As soon as self-worth is set as equal to 'nett worth' you have a personal problem with money. At this stage the perception of money not only begins to define your character and individuality, but also permeates into the relationships with spouse, children, parents and even second and third tier relationships. This is a graver and deeper problem than having the Debt Monster on your doorstep and can be a result of a personality issue requiring long term psychotherapy."

It is essential that we identify 'the illusions' that we project onto money that we then make our 'reality'. These 'illusions' capitalizes on our fears. If you have debt you are busy mismanaging your finances and most probably your goals and objectives are blurred.

Firstly, how do you categorise between being ill-informed about money matters, making a few wrong moves and then falling into debt; and secondly whether an individual has a deep routed obsession with money itself and needs professional help?

Debt can happen to anyone, and most likely will happen to everyone at some stage. Debt can be the result of one or two bad decisions or it can be because of unforeseen emergencies. When an individual has an obsession with money it is more often than not a result of a deep seeded psychological problem. The individual could have been deprived of attention when they were younger and attached the reward of buying an item as making them feel worthy. This can easily spiral out of control and become a way of life.

"Debt is not a death sentence, nor should you attach any type of self-worth to it," says Hein du Plessis, Managing Director of DebtSafe. "Debt need only be a temporary situation." DebtSafe counselors have a passion for giving each indebted individual a new beginning and through restructuring of debt they have managed to reduce repayments by up to 54%.

Lastly, Flemmer adds that the cornerstone of emancipating yourself from the negative influence of money is to value yourself enough to want to take your control back. Taking control back means using your money realistically, which means it's a 'means' to an end' and 'not an end in itself'. In this way self-discipline becomes self-caring and not self-punishment. Psychological advice when dealing with debt is "If you want to self-destruct, debt and money will oblige your intent so beware!" Source the help you need and don't get emotionally attached to the problem. wn

For more information visit DebtSafe at www.debtsafe.co.za.

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"Living amongst the stars at the Johannesburg Observatory"
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You said...

Dear Editor,

The article by Rob Thomson on the Duvha Power Station turbine failure emphasises the risks involved in handling large quantities of power. His comparisons of these risks with those associated with aircraft, although appropriate to some extent, are not entirely relevant.

He compares the recent catastrophe at Duvha with the one at Vereeniging Power Station in 1925. He even does some calculations based on a mean time between failure of 43.5 years. The two incidents were both caused by the power of the steam pressure acting on the rotor alone thus accelerating the rotating mass to destruction. Normally the megawatts of steam are converted to electrical power that flow into the network. Above mentioned overspeeding scenarios arise when the steam valves are wide open with the electrical network not connected. At Duvha the scenario apparently happened during an overspeeding test when, due to an operating error when manual closing of the the steam valve was not done in time.

The situation at Vaal Power Station was quite different. During the sixties I was Protection Engineer in Escom Head Office, responsible for the design of protection relaying systems for generators at power stations such as Camden, Grootvlei and Hendrina power stations. The main purpose of the protection is to shut down the turbogenerator safely, should a fault occurs, usually electrical ones such as stator earth faults. I had the privilege of working under engineers such as the late Peter Randall and Ron Slatem. It was only natural that they would relate the infamous Vereeniging Power Station incident in detail. It was told that a part of the exciter landed on the opposite bank of the Vaal River! Based on this incident, Peter Randall designed Escom's generator protection schemes in such a way that closing of the steam valves and opening of the release valves are initiated the same time as the tripping of the main circuit breakers. Peter Randall published a paper[1] in the SAIEE Transactions in 1965, dealing with the topic in detail. It is an interesting read. The incident at Vaal occurred, probably because the protection scheme relied too much on governor action closing the valves. I seem to recall that the governor failed.

Rob Thomson's article brings home the fact that, when dealing with large amounts of power, utmost care should be taken, including exhaustive checking and double checking.

Kindest regards

Koos Holtzhausen (Senior Member).

University of Stellenbosch

1. R.P Randall, "Precautions against overspeeding of turbo-generators", Transactions S. A Institute of Electrical Engineers, Vol. 56, June 1965, pp. 147-171

ED - Dear Mr. Holtzhausen, thank you for your letter. We value your opinion.

Dear Minx

Thanks for the very interesting article by RGW Thomson, regarding the Duvha and Vereeniging failures with some fascinating historical facts, unknown to me at least, regarding the latter. I am very happy that the author referred to the Duvha incident as a "Failure" and not an "Accident", because an unavoidable freak occurrence it was clearly not. I have not seen a detailed technical analysis in the technical press yet and not being a turbine expert, my opinion must be influenced by the information generally available. However, it is difficult not to think in terms of gross negligence and incompetence. As Thomson pointed out, sophisticated equipment always come with strict test procedures that should be carried out in a carefully planned and executed sequence, by well trained technicians and under experienced supervision. It is extremely difficult to see how that could have been done in the Duvha case. Much is made of the fact that apparently nobody was present at the final overspeed panic button. Yes, that is clearly deplorable, but generally that type of intervention is intended as a total last ditch belts and double braces action. Whether the protection is correctly functioning or not, should be evident from proper testing long before that final panic stage is reached. With transformers and other high energy electrical equipment, fault conditions can be simulated and injected, without actually risking destruction to see if things have been done right. I am sure it is no different with turbines.

In my view the real cause of the problem lies deeper than just the particular chain of events and it is impossible not to consider aspects like removal and substution of institutional technical knowledge and commensurate experience, as now commonly visible in industry. With those firmly in place, the occurence of such capital destruction is generally prevented and limited to real accidents.

The generic problem is highlighted in the same issue of your publication, by Wolf

Weidemann's very relevant letter. The figures quoted by him regarding the lack of formal and organised technical training, are cause of real concern and clear evidence about the lack of appreciation about its importance in a growing modern economy. If that happens in organisations whose businesses are technology based and totally dependent on such human capital, the effects are disastrous, as we have read.

Without a real re-appraisal of those values, we are bound to see more of the same. There is just no substitute for properly constituted, measured and formal training, both outside and in the workplace. And funny thing, it takes approximately 10 years to get 10 years of experience.
Riaan Wolhuter (Pr Eng)

ED - Thank you for your valuable opinion.

Dear Editor,
I really did not mind and strangely prefer the soft magazine. It was easier to handle, carry around and file/bind and I preferred it for the environment's sake.

The last **watt**now communications edition is too glossy and stiff. Magazine looks good and feels good, but deep inside I feel a little BAD. Thats my 2 cents worth. Excellent magazine nonetheless!

NISHAL PRANLALL
Signal Engineer-[MetroRail KZN]
DURBAN

*ED - Thank you for your comment on the **watt**now magazine - sometimes people tend to feel sentimental with change, but don't judge a book only on it's cover, the content is fabulous and very informative. Even I learnt a few things!*

Dear Minx

Thanks for printing my letter regarding Free Energy. This letter is just a quickie to let you know that it will be some time before I can respond with more info on Free Energy as I am going into hospital in three days time for a hip replacement operation. When recovered I will then be having the second hip replaced.

In the meantime, however, you may get some quite interesting responses as the subject is a very fascinating and controversial one.

Kind Regards
John Howard Davies Pr. Eng MSAIEE.
ED - Thank you for your letter Mr Davies, we wish you all the best with your operation and we look forward to more news from you regarding Free Energy.

To The Editor
The article by Les Stuart of Southern Cape - "HESSEQUA Municipality" (**watt**now Jan 2012) "First Municipality to become an Independent Solar Power Producer" refers. I read the Contribution, apparently a Green Award Winner, with interest, and not a little dismay.

Les writes from the moral high ground now prevailing Renewable Energy, Carbon Footprints, Energy Efficiency, etc. In my view much of what is written in this context is perceived by the populace as the truth, the whole truth… And if I may say so, academics and Students are in the forefront of Renewable Energy enthusiasts.

The HESSEQA Municipality story begs many questions. From my standpoint, and as an old practical Electrical Engineer, very little make sense. Does this 'toy' project really feed into the Grid? The municipality will own the asset, which was funded by the Dept Of Energy; yet under COP17 is expected to be self-funding? What crazy interpretation of Economics enables an IPP to produce power at a loss, sell it at a profit to the SBO, and then take a separate supply from Eskom at consumer Rates? More questions come to mind, but my objective is to get a bit of a debate on the go, to hear what more of the old 'smoke stack' era guys feel.

Eskom has enough on its plate to warrant silence; but maybe the IDC can be persuaded to comment?

This is a debate, which must entered into, and for starters why not in the **watt**now magazine?

Our Government has embarked on many disastrous projects over the last decade or so - the Arms Deal, the ESKOM saga, the soccer stadiums, Low cost housing, Super Toll Roads, Gauteng Xpress, and more. Is it too early to pronounce on the sluggish Wind Farm program? The Government's Energy Policy, now well formulated, could well bring the country to its knees.

Perhaps this note could be given a spot in 'letters to the Editor'? Maybe Les Stuart will start the debate. Whatever, but please do see if there are any other views about?
Thanks
Travy Brick

ED - Mr Brick, thank you for your letter, I've published your letter as requested, and let's see who will enter into this debate. Watch this space.

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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.

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What's In It For Me?

Members of the SAIEE now enjoy a wide array of benefits starting at a R950 discount on their ECSA registration fee which is due in April every year, provided you join the SAIEE before the end of March of the same year.

Upon joining the SAIEE there is a standard entrance fee of R650 and an annual membership fee of R756.00 for members, and between R924.00 and R1002.00 for senior members depending on age. Most of this will be recovered through the ECSA discount.

SAIEE members receive 11 issues of the **watt**now magazine valued at R330 along with the quarterly African Research Journal - our local research and development magazine.

However, the real rewards of being a SAIEE Member can be realized through attending our monthly lectures, debates, tours and site visits, which are mostly free and accompanied with refreshments at no extra cost. Members are awarded valuable CPD credits for attending these events & functions.

Being a member has significant career benefits, as membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for its members to interact with normally inaccessable senior leaders in the industry. Letters after your name indicate your membership grade and are a useful measure of 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 in gaining professional status through the Institutes large database of mentors. SAIEE members are awarded 1 CPD credit (Category3) for being a member.

Members are able to serve on organizing committees and gain valuable experience in doing so, while learning how to run formal meetings and practice technical presentations in a low risk environment.

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 ***CV***;
- The completed ***application form***;
- ***Proof of payment*** for the application fee. Membership fee will be comfirmed on acceptance of membership.

Copies of the above listed documentation should ***accompany the application forms*** but frequently are submitted after the application forms are sent in.

A number of applicants do not fill in every answer to questions asked on the application forms, ***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!!

Membership Fees

Effective January 2012

Council at its meeting held on 02 September 2011 decided that subscription and entrance fees as from 01 January for 2012 should be as indicated below. Please note: In terms of Bylaw 3.2 annual subscriptions shall become due on 1st January each year. To encourage members to pay their subscription fee early, Council agreed to allow a discount if such fees are paid before 31 March 2012.

Grade of Membership	Annual Subscriptions paid before 31 March 2012		Annual Subscriptions paid after 31 March 2012		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	106	75	118	84	118	84
After 6 yrs study	684	486	760	540	760	540
Associate	684	486	760	540	760	540
Member	756	537	840	596	840	596
after 6 years	884	627	982	697	n/a	n/a
after 10 years	924	656	1,027	729	n/a	n/a
Senior Member	924	656	1,027	729	1,027	729
after 6yrs/age 40	1,002	711	1,113	790	1,113	790
Fellow	1,002	711	1,113	790	1,113	790
Retired Member (By-law B3.7.1)	423	300	470	334	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 R650 (except Students which is free)
2. Transfer fee to a higher grade is R300.00 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 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.

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 on written application to Council, be exempt from the payment of further 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 July of each year will be struck-off the SAIEE membership role subject to Council decree.

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www.saiee.org.za

Calendar of events

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

MAY 2012

6-10	WISA Conference & Exhibition	Cape Town International Conference Centre, CT	www.wisa.org.za
7-10	The Learning & Development Conference & Exhibition	Sandton Convention Centre, Johannesburg	www.terrapin.com
8	Cloud Computing World Forum Africa	Sandton Sun Hotel, Johannesburg	www.cloudcomputinglive.com
10-11	The 4th KKU International Engineering Conference 2012	Khon Kaen, Thailand	tisd.en.kku.ac.th/kku-ienc2012
10-12	Umalusi 2012 Conference	Ekudeni Resort, Johannesburg	www.umalusi.org.za
13-18	World Congress on Water, Climate & Energy 2012	Dublin, Ireland	www.iwa-wcedublin.org
14-17	Mobile Money Africa 2012	Southern Sun Montecasino Hotel, JHB	www.mobile-money-gateway.com
15-16	Solar Power Mexico	Mexico City, Mexico	www.greenpowerconferences.com
20	IPower System Operation and Energy Management	Bangalore, Karnataka, India	interscience.in/intconf/ICPSOEM
20-23	Resources & Energy Symposium 2012	Broken Hill, NSW, Australia	www.symposium.net.au
21-23	SASEC 2012: 1st Southern African Solar Energy Conference	Protea Hotel, Technopark, Stellenbosch	www.sasec.org.za
21-24	African Utility Week	Johannesburg Convention Centre, Johannesburg	www.african-utility-week.com
21-24	Metering Billing CRM-South Africa	JHB Expo Centre	
21-24	SatCom Africa	Sandton Convention Centre, JHB	www.terrapinn.com
21-24	Telecoms World Africa Conference & Exhibition	Sandton Convention Centre, Johannesburg	www.terrapinn.com
22-23	Mobility, Migration, Development & Environment Conference	University of South Africa, Pretoria	momiden-2012.info
23-24	Industrial Sustainability Conference	Protea Hotel Balalaika Sandton, Johannesburg	momiden-2012.info
24	2nd Iranian Conference on Smart Grids (ICSG 2012)	Tehran, Iran	www.icsg.ir
26-27	Innovations in Electrical and Civil Engineering Conference	Phuket, Thailand	www.psrcentre.org
28-30	4th Wind Power Africa Conference	Cape Town, RSA	www.afriwea.org

JUNE 2012

2-3	2012 4th IEEE Intl Conf. ICCSN 2012	Zhengzhou, China	www.iccsn.org
6 - 8	10th West African International mining & power exhibition	Accra International Conference Centre, Ghana	www.exhibitionsafrica.com
16-17	Electrical and Electronics Engineering Conf. (ICEEE'2012)	Bangkok, Thailand	www. psrcentre.org
23-27	8th World Congress on Cost Engineering, Quantity Surveying and Project Management	International Convention Centre, Durban	www.icoste.org
25-29	Africa Rail 2012	Sandton Convention Centre, Johannesburg	www.terrapinn.com

JULY 2012

15-17	SAITEX 2012	Gallagher Convention Centre, Midrand, JHB	www.exhibitionsafrica.com
16-19	Africa Mining Congress 2012	Sandton Convention Centre, Johannesburg	www.terrapinn.com
20	East Africa Business Summit & Expo 2012	Hilton Sandton Hotel, Johannesburg	www.eastafricabse.com

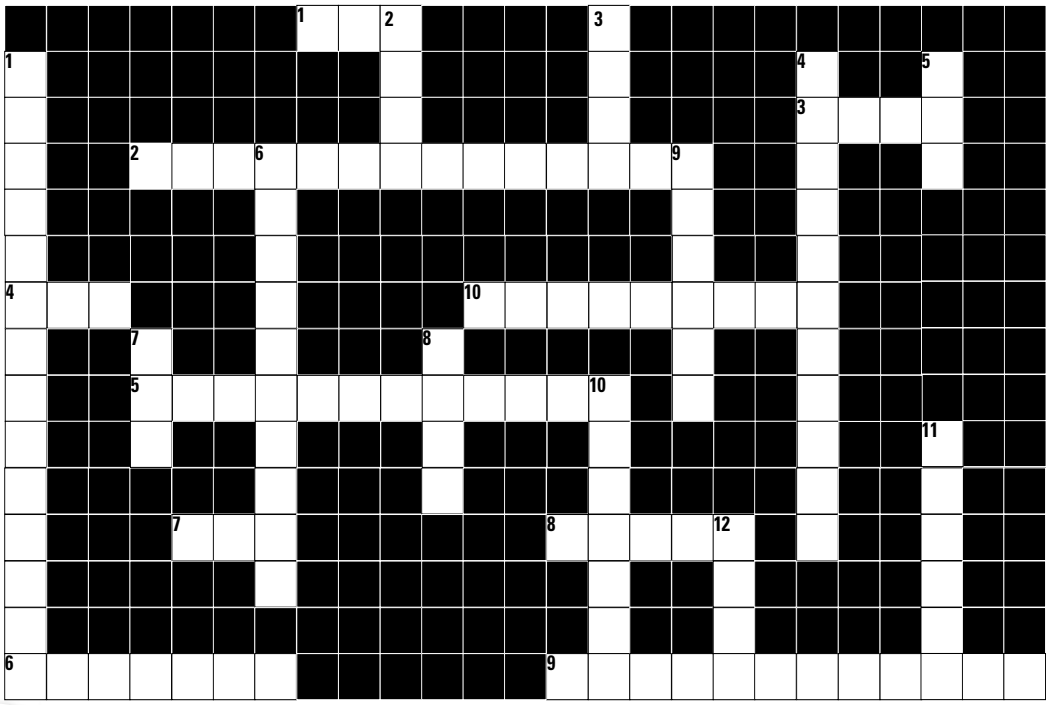
AUGUST 2012

13-17	The Cosmic Kaleidoscope: Pulsars and their Nebulae, Supernova Remnants and More	Kruger Park, South Africa	fskbhe1.puk.ac.za/knp2012/

win R1000

Have some fun and stand a chance to win R1000. Complete the April issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, April 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 **31 May 2012**. The winner of R1000 will be announced in the June issue of the **watt**now magazine.

ALGAE-X, THE TANK CLEANING SPECIALISTS, ARE THE PROUD SPONSOR OF OUR CROSSWORD PUZZLE.



ACROSS

1. Digital Multimeter (abbr.) (3)
2. In solar panels, the DC electricity is controlled via a _____ (14).
3. Open Wire Telepjone Lines (abbr.) (4)
4. Global Positioning System (abbr.) (3)
5. The solar panel is _____? (12)
6. Name of 2011 SAIEE President (7)
7. Cathode Ray Tube (abbr.) (3)
8. Surname of 10 down (5)
9. Used to measuring time-varying signals (12)
10. One of the two candidate locations for the SKA (9)

DOWN

1. **watt**now magazine is a media sponsor of this conference & exhibition taking place in JHB in November 2012 (14)
2. Name of the 2012 SAIEE President? (5)
3. Horizontal Axis Wind Turbines (abbr.) (4)
4. See 10 across? (4)
5. National Long Distance (abbr.) (3)
6. Betz's law is a theory about the maximum possible energy to be derived from a wind turbine developed in 1919 by which German physicist? (10)
7. Continuing professional development (abbr.) (3)
8. When measuring current, it is important to remember that current is a _____ variable. (4)
9. Name of the SAIEE Honorary Vice President. (6)
10. Who invented the frst wind Turbine in 1887? (7)
11. Dr. Pat _____, SAIEE Senior Vice President. (6)
12. Surname of 9 down (4)

Power Crossword Winner: Mr Johan Uys from Bellville

ACROSS

1. Five
2. Storage
4. Carbon Dioxide
6. Nanotubes
8. Low Pressure Sodium
9. Brayton
11. Watt

DOWN

2. Seven
3. Insolation
5. Ingula
7. Gourikwa
10. Coal
12. Cube
13. Hydro Electric

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 31 May 2012. 8. The winner will be announced in the June issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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