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The Electrical issue

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

5th ANNUAL CONFERENCE, EXHIBITION & SITE VISITS

CLEAN POWER AFRICA

CONFERENCE & EXPO 2012

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Why attend:

- Listen to latest updates on new innovative mini-hydro schemes
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- Find new technologies to suit your hydropower challenges

To get involved, contact Nicolaas Loretz on +27 21 700 3555 or email: nicolaas.loretz@spintelligent.com
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What to expect?

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- Over 45 speakers
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- Post-event technical site visits

3 – 6 September 2012
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wattnow magazine

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ISSN: 1991-0452

I can't believe it is August again and I've been a part of this prestigious institute for a year. I just find it absolutely amazing how quickly time passes, especially when you are having fun.

In this August issue, we focus on Electrical pioneers and manufacturers, from our James Watt feature on page 16, to our 1912 Transactions on Electrical Machinery, on page 50.

This past year has been a HUGE learning curve for me, especially editing a magazine and really not understanding what is being discussed. Now, a year later, I understand what a transformer does and what it looks like, thanks to Silas Moloko who explained it to me in plain English, at our recent visit to the Powertech Transformer site in Pretoria.

The best part of all is to be associated with a professional society like the SAIEE – which means YOU, our valued member.

I've had an overwhelming response to the Live & Lead Competition, but Mr Brenden Joynt from Cape Town and Mr Jules from Durban were the two lucky winners.

Now that Spring is around the corner and with it comes our National Braai day on the 24th of September, and what better time in giving away 2 new books from our very own Jan Braai. Go to page 55 and enter the competition.

Our iPad competition time is running out - the 5 winners of this competition will each win an iPad (see page 5). Please send me your articles as soon as possible, to stand a chance to win an iPad. It only leaves you with September issue to qualify for this competition.

Please send me your letters, articles, comment or just anything you want to share with your fellow members. I'm looking forward to it.

Enjoy the read.

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, and in doing this, earn 1 CPD credit when your article is published in the **watt**now magazine.

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

Once again I write to you, with more than half of the year having past, and this publication, **watt**now, going from strength to strength.

During July, the American Institute of Electrical and Electronic Engineering's Power & Energy Society (IEEE PES) organized "Power Africa" hosted by the University of the Witwatersrand. This was, by all reports, a great success.
The President of the PES, Dr Noel Schulz, as well as a number of her vice Presidents visited South Africa for this event.

On Tuesday the 10th of July members of Council and I met with Dr Noel Schulz and her PES colleagues at SAIEE House to review the Memorandum of Understanding which exists between our two organizations. Very productive discussions were held, relating in particular to joint activities and coordination of technical meetings, publications and possible mutual access to them by members of each of the Institutes, and membership. In this regard it was noted that the joint Student Chapters at our tertiary institutions are proving to be very successful. Thanks to Professor Ken Nixon, one of our Council members for his assistance in this initiative. The session was concluded by an automated slide show compiled by Dirk Vermeulen, Vice-Chairman of the Historical Section, of the SAIEE, entitled: "A peep into 100 plus years of Electrical Engineering in Africa." This presentation can be made available to our centres on request.

The following day, the SAIEE hosted a breakfast briefing in the Council chamber (another first). We were addressed by Dr Noel Schulz – a very interesting talk on women in engineering. Noel has an impressive CV – she is currently the Palsay Professor of Electrical & Computer Engineering at Kansas State University. She received her PhD from the University of Minnesota after having received her bachelor and masters degrees at Virginia Polytechnic Institute and State University. She is married to an Engineering Professor and has two grown-up sons.

It was again my pleasure to present my Presidential address on the 25th of August. This 9th time, it was the East London Interest Group. The event took place at the East London Golf Club set in very picturesque surroundings and was attended by 20 members. Thanks to the group's Chairman, Simphiwe Hashe, who organized the venue, and the cocktail party that followed. The Council was also thanked from the floor for the interest taken in the group, - the address, the CPA courses run there, and the **watt**now.

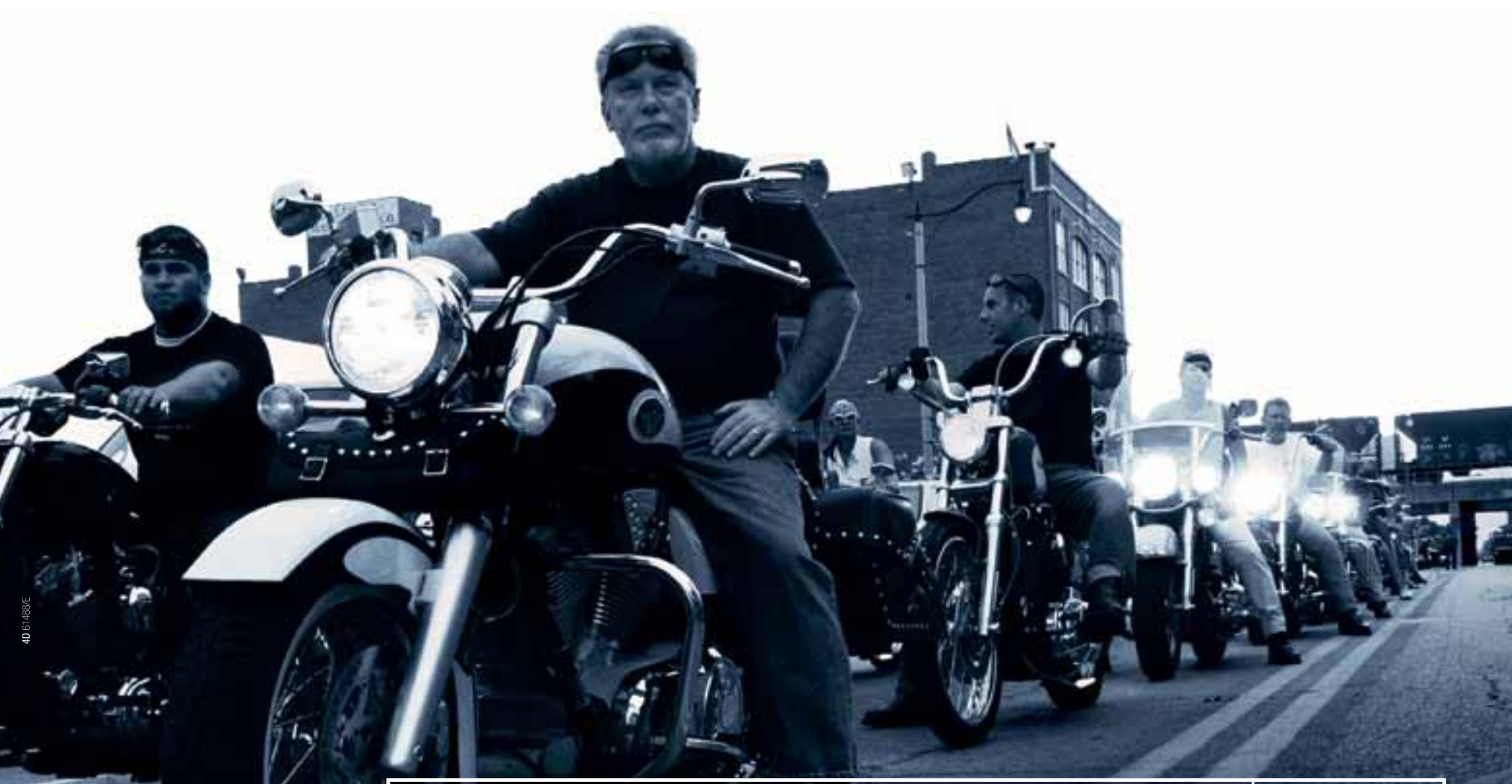
Simphiwe and Ben Kotze chair the Interest Groups, of which we have two – one in East London, and the other in Bloemfontein, respectively. If the chairman can get 10 Senior Members and/or Fellows to sign, Council will be able to upgrade the interest groups to centres. In both of these areas we have more than the prerequisite number of these members.

It may not be too well known, that after 6 years in a membership grade, one can apply to be upgraded to the next level of membership. This would definitely increase the numbers of Senior Members and Fellows in the Institute.

Finally, I would like to welcome all our new members. We are expecting to increase our membership further, as we have canvassed Engineers registered with ECSA, who are not members (the discount for Voluntary Association membership offered by ECSA from its annual registration fees pays most of, if not all, the Institute fees).

We should shortly have a registered membership of 6000, and will then target to increase it further to 7000.

Mike Cary | SAIEE President 2012



1969 signalled the beginning of the end of Harley-Davidson. The family brand founded in 1903 was sold to a company with no motorcycle experience. Profits fell as quickly as quality, and the company was almost bankrupt when a group of Harley-Davidson executives, led by the grandson of founder William A. Davidson, bought it back in 1981. Under their leadership, Harley-Davidson went from strength to strength. An ad campaign trumpeted the company's new philosophy: Motorcycles by the people, for the people.

Those folks knew something we at PPS have long believed - that the key to success lies in sharing it. That's why our clients are members who share in our profits. It's called mutuality, and it's just one of the ways we've been protecting the wealth and security of graduate professionals for over 70 years.

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WATTSHOT

In this issue, we feature some gadgets and gizmo's for the tech savvy!

SPY PEN VIDEO RECORDER

Disguised as a fully working pen, this miniature video camera, is perfect for covert surveillance.

If you need a spy camera that's body mounted, there's nothing easier or more discreet than just putting this pen camcorder in a shirt pocket for a full view of everything you see in front of you.

Featuring full-colour video and sound recording, 8GB of internal memory, means that you can start the Spy Pen filming and then forget about it. Just clip it to your pocket and walk around somewhere that you want to film, or leave it in place to record a face to face conversation. If you want to record in an office environment, then you could just leave it in a stationery holder, or position it to look like it's just another pen that's been carelessly left on a desktop. Retail for R799 (incl.)

BOLD FOR MEN DRY SHAVE™ 120ML

BoldForMen's Dry Shave™ Gel redefines the traditional shaving experience. It was designed with the intention of creating a solution for all men suffering from mediocre shaves. This is why the Dry Shave™ is so bold and unique. It not only delivers a smooth shave but it can also be your complete 3-in-1 shaving regimen (Pre-Shave, Shave and After-Shave). It's simply men's grooming at its best. R279 (incl.)

SPY CLOCK WITH MOTION DETECTION (SILVER)

This product is high-definition digital camera with motion detection embedded into a small size table clock. Supports micro SD card (not supplied), it's great for home security, and a slew of other practical uses. Compact size(only 48*45*18mm) allows it to be concealed and placed anywhere. Built in battery support extended recording time and easy charging. R950 (incl.)

MAZE TOILET ROLL

Make your bathroom a more interesting place with this novelty toilet roll. Featuring a maze puzzle printed directly onto the sheets it gives you or your visitors something to pass the time when they're seated on the throne.

Use a pen, pencil or just your finger to trace a path through the maze and when you're done, use it like you would normal toilet roll, then flush it away.

Features | Fantastic maze toilet roll | Specially customised toilet roll | Perfect novelty gift | 15 metre roll - 150 sheets (10cm x 10cm). R95 (incl.)

RPM RHODIUM CUFFLINKS SET

This stylish pair of cufflinks that will add flair to any cuff. Rhodium cufflinks are not only exquisite but durable, so they'll last a lifetime without the need for polishing using corrosive/messy liquids. A cufflink presentation box (pictured below) is included.

Rhodium is a chemical element that is a rare, silvery-white, hard and chemically inert transition metal and a member of the platinum group. Naturally-occurring rhodium is found as the free metal, alloyed with similar metals, and never as a chemical compound. It is one of the rarest precious metals, and the most costly. Rhodium is a so-called noble metal, resistant to corrosion, found in platinum- or nickel ores together with the other members of the platinum group metals. It was discovered in 1803 by William Hyde Wollaston in one such ore, and named for the rose color of one of its chlorine compounds, produced after it reacted with the powerful acid mixture aqua regia. R356 (incl.)

ROCKING WHISKEY GLASSES (6 PACK)

Stylish glass tumblers, or Weeble ghosts? We're not sure, but while we investigate further why not use one of these Rocking Whiskey Glasses to swill your scotch? Just place one on a flat surface and it'll roll around its gently-curving base, swirling your drink for you.

Regardless of how much of your favourite tipple is inside them, these innovative glasses will never topple over. But give them a nudge and watch as your jittery guests dive to catch them. Perfect for parties and knowing when you've had one tipple too much – if the room is spinning and your Rocking Whiskey Glass is staying perfectly still, it's time to wobble to bed. R350 (incl.)

The products in the **watts**hot *section can be purchased online on www.mantality.co.za unless otherwise specified.*

WATTSUP

CLEAN POWER AFRICA IN CAPE TOWN TO FOCUS ON NEW OPPORTUNITIES IN HYDRO AND SOLAR INDUSTRIES

The Clean Power Africa conference and exhibition in Cape Town in September will focus on new opportunities in the clean energy sectors such as retrofitting hydropower to current dams and helping the mining industry to use excess water to provide onsite power.

South Africa's Energy Minister Elizabeth Dipuo Peters will welcome delegates at the official networking reception at the event which will boast over 600 visitors from across the globe. Clean Power Africa incorporates the fifth edition of the hugely successful Hydropower Africa 2012 conference and exhibition and the second year of Solar Energy Africa.

NEW OPPORTUNITIES

Says the Clean Power Africa conference director Nicolaas Loretz: "*We have found that most utilities, municipalities and governments need more insight into retrofitting hydropower to their current dams. Also new opportunities have arisen in the mining industry where excessive water or flooding is now used to provide onsite power for mines and the Clean Power Africa programme will elaborate on this.*"

He continues: "*a very exciting trend in the hydropower sector is that conduit hydropower and generating hydropower energy from current water distribution systems are getting more and more traction and most utilities are now looking to capitalise on this.*"

SOLAR UPDATES

According to Loretz, South Africa's Renewable Energy IPP Procurement Programme will be discussed and Energy Minister Dipuo Peters, will elaborate on the way forward. "*The programme will also provide up-to-date information on major projects and future prospects for project development, including mini, small and large hydro as well as PV (Photovoltaics) and CSP (Concentrated Solar Thermal Power). More coal-fired power plants are now incorporating CSP and the programme will include updates on this*", says Loretz.

CLEAN POWER AFRICA PROGRAMME HIGHLIGHTS INCLUDE:

- Perspectives on Africa's renewable energy potential and trends and prospects on emissions trading;
- Education and capacity building in the clean power industry;

HYDROPOWER AFRICA:

- Realising the potential and development of small hydropower and pumped-storage projects in Africa;
- Retrofitting hydropower to South African dams;
- Hydropower Sustainability Assessment Protocol and how hydropower works alongside other renewables;
- Neusberg 10MW small hydro plant for RSA REFIT Programme – contractual and technical challenges;
- Workshop on Conduit Hydropower and generating hydropower energy from current water distribution systems.

SOLAR ENERGY AFRICA:

- Potential for CSP to be incorporated with South Africa's coal-fired plants;
- How to successfully integrate PV/CSP and wind into the Grid;
- Thermal energy storage as an enabling technology for renewable energy.

SITE VISITS

The event will also host site visit tours to some of the most exciting and power plants in Africa, including Katse Dam (one of the 10 largest concrete arch dams in the world in terms of its volume), Steenbras (the first hydroelectric pumped-storage scheme in Africa), Palmiet PSS (won an award for Most Outstanding Civil Engineering Achievement by SAICE) and South Africa's first concentrated photovoltaic (CPV) solar demonstration plant at the Aquila safari lodge, near Touws River.

EVENT DATES AND LOCATION:

Pre-conference workshops:
3 September
Conference and exhibition:
4-5 September
Site visits:
6 September
Cape Town International Convention Centre (CTICC), South Africa
www.cleanpower-africa.com

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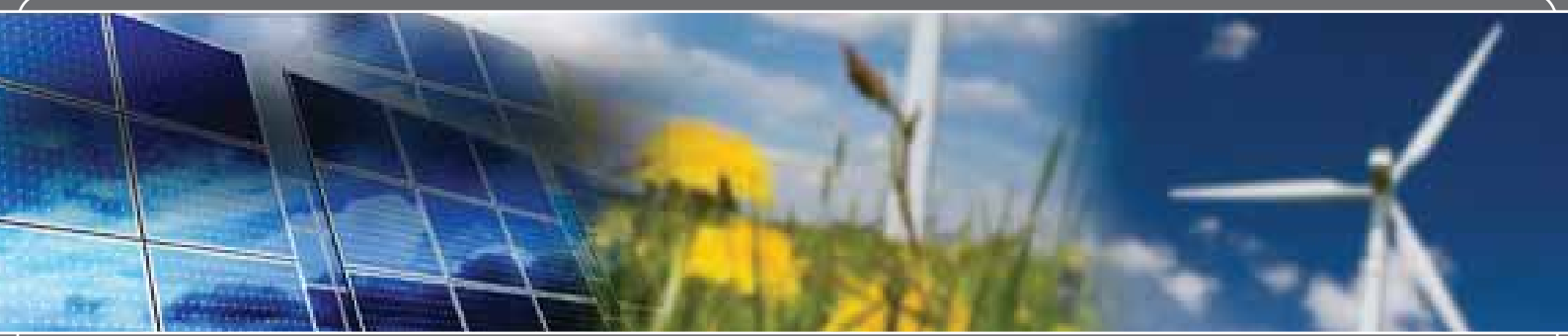

Don't miss out on this opportunity!

- Gain knowledge on the current status and potential for solar energy development in Africa
- Hear about the largest Solar Park development in Africa
- Discover the potential for using solar energy to power your operations on site
- Examine successful Feed-in Tariff programmes and their impact on Power Purchase Agreements (PPAs)
- Gain insight on the commercial potential for the development of grid-connected and off-grid solar energy projects
- Get updated with new energy storage technologies and solutions
- Solar Energy Africa is a niche convention forum that promotes the sustainable, effective and financially viable use of both PV and CSP and is aimed project developers, consultants, regulators and utilities from across Sub-Saharan Africa.

Call us now to book your seat:

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Host utility: Eskom

Host city:

Co-located event: HYDROPOWER AFRICA

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spintelligent
CLARION EVENTS

WATTSUP

Alexandra Zagury
RIM Managing Director

RIM APPOINTS ALEXANDRA ZAGURY AS MANAGING DIRECTOR FOR SOUTH AFRICA AND SOUTHERN AFRICA

Research In Motion (RIM), the company behind the BlackBerry® solution, announced the appointment of Alexandra Zagury as Managing Director for South Africa and Southern Africa.

Based in Johannesburg, Zagury will oversee all of RIM's operations, sales and marketing efforts for the region.

Commenting on her appointment, Alexandra Zagury said: "I am excited to be taking on the role of Managing Director for the Southern African region, one of RIM's most important growth markets. We are proud of the company's success in this region, particularly in South Africa where BlackBerry is the leading smartphone brand, and I believe there is still tremendous opportunity for growth. Our goal is to maintain customer loyalty and expand RIM's leading position in South Africa by being even more customer-focused and by working closely with our carrier and developer partners across the region."

RIM is growing from strength to strength in South Africa. According to GfK Retail and Technology, BlackBerry® smartphones accounted for 7 out of the 10 best-selling smartphones in South Africa in May 2012. GfK data in May also shows that BlackBerry has been the leading smartphone vendor in South Africa for over 20 months.

FIRST WINDOWS PC LAPTOP AVAILABLE THROUGH FNB

For the first time First National Bank (FNB) will have a Windows PC Laptop available as part of their popular Tablet and Smartphone offer. Along with an array of smartphones and tablets, FNB will include the Acer Windows PC Laptops and Ultrabooks to the range of products that are available at a reduced price - with 24 months to pay and zero additional fees, interest or charges

New and existing FNB Gold or Platinum Cheque Account clients as well as FNB Private Clients will be able to purchase any of the following Acer products: The Aspire S3 Ultrabook with Core i7 processor, The Timeline M3 Ultra and the Value Series V3 Laptop. Each of the products offered have different price points thus ensuring that it is available to a large and targeted audience.

"At Acer we will continue to aim at bringing mobility to consumers in an easy and convenient way," says Celeste Gibbens, Acer Africa Marketing Manager. "We are delighted to partner with an innovative bank such as FNB on this project."

The Acer S3 Aspire was the first Ultrabook to be revealed in October 2011 and Acer has continued to exceed each benchmark combining the essential features of the smartphone and tablet PC, such as fast startup and internet connectivity, with long battery life and convenience. "Mobility is a key component for FNB and being able to provide our clients with a product that is not only ultra-convenient but offers portable accessibility wherever and whenever" says Ilse Smuts, Head of Marketing at FNB's Core Banking Solutions.

Clients can order their new PC Laptop by visiting fnb.co.za or by SMSing "pc" to 32812 (standard network rates apply). In line with the existing tablet and smartphone offer, customers will have the opportunity to acquire the Acer PC Laptops and repay it over 24 months at a reduced rate and with zero additional interest, fees or charges payable. The monthly payment is added to the customer's monthly account charge.

SAMSUNG REVITALISES THE GALAXY NOTE WITH THE PREMIUM SUITE

Samsung Premium Suite will deliver an enhanced experience on top of detailed usability enhancement and ICS upgrade

Samsung Electronics Co. Ltd., the global leader in Android smartphones, today announced the local availability of the Premium Suite software upgrade for the GALAXY Note. The Suite provides a richer 'note taking' experience via S Note, My Story and S Memo Widget while a much faster and seamless user experience is possible thanks to the Android 4.0 Ice Cream Sandwich (ICS) upgrade.

Says Craige Fleischer, Director of Mobile Communications at Samsung Electronics SA: "Samsung puts customers first by providing differentiated value and as such; as much effort and resources that go into developing a new device has gone into the Premium Suite upgrade - a highly anticipated upgrade locally and one we truly feel will add a little extra GALAXY experience to our Note customers."

SOUTH AFRICAN LEADS THE CHARGE IN SOLAR CONNECTIVITY

In a world-first South African entrepreneur, Peter Graham, launched a solar-powered connection centre in the Thusong Youth Centre in Alexandra Township. The custom designed connection centre is an integrated, self-contained, mobile solar powered container which provided 100% off GRID power for multiple and simultaneous Internet user access, transforming township communities.

Some of the features and benefits of this social investment project include an educational upliftment, sustainable job creation whilst at the same time providing for the creation of monthly recurring revenue generated from the sale of products and services processed through the Easy Pay Kiosk (prepaid airtime, prepaid electricity, EFT's), advertising, as well as from other facilities offered E.G. cell phone charging, photocopying, scanning and faxing.

"The idea behind the container is to provide low-cost access to services that will enhance residents' lives. Amongst other things, the centre will provide jobs, save on commuting costs and give access to the Internet and e-mail on an uncapped data supply line via fast and reliable satellite connectivity, explains Graham".

ESKOM'S SUPPORT HELPS RURAL SCHOOL WIN NATIONAL NUTRITION AWARD

Eskom's energy and sustainability programme boasts a long-standing partnership with the Wildlife and Environment Society of South Africa (WESSA). It is through this programme that they encourage support for the environment through over 150 projects in schools around the country.

One such school is Tsembaletfu primary school in Kabokweni, Mpumalanga – recently the proud recipient of the laudable "Leader in the National School Nutrition Programme Award".

In 2011, the Eskom energy and sustainability programme launched a new section to their programme, the 'edible plant network' (EPN). This initiative encourages schools and community members to participate in growing healthy food in a sustainable way. A substantive donation was made by the initiative to Tsembaletfu primary school to enable them to build a nursery, stock it with equipment, teach their learners about plant propagation and establish a food forest.

Under the capable leadership of coordinator Louise Wlliamson, the school's committed educators, the 20 "enviro mentors" and grade 2 and 3 classes the school embraced the project and were so successful that, in just under a year, they received the prestigious award along with R400 000 worth of resources for the school.

POWERTECH SITE VISIT

On Wednesday 15 August 2012 a group of SAIEE members visited the Powertech Transformers plant in Pretoria West. Powertech Transformers is 80% owned by Power Technologies (Pty) Ltd, the largest power-electrical group in Southern Africa and 20% owned by Power Matla (a local black empowered company). Powertech, is a wholly owned subsidiary of Altron.

Power and distribution transformers for the African continent are manufactured by Powertech Transformers at its operations in Pretoria West, Cape Town and Johannesburg.

WATTSUP

PNEUDRIVE CHALLENGE – A PLATFORM THAT ADDRESSES THE SKILLS GAP AND TAPS INTO THE POWER OF YOUTHFUL INNOVATION

This year's theme, *"Engineering a Better Life for South African Communities"*, was suggested in order to encourage mechanical, electronic and mechatronic engineering students to stretch themselves beyond their typical academic and engineering design boundaries. Rene Rose (GM of Marketing and Communications at SEW Eurodrive) feels that "by allowing students to submit designs that can improve and influence the lives of people within their own communities, we are confident that we will receive a range of innovative and possibly life-changing entries that will showcase the young engineering talent that we have in South Africa".

Since its inception in 2008, the competition has seen hundreds of students exposed to the learning and design potential of the competition. More than 20 thought provoking designs have been submitted through the years, with some designs generating international enquiries. This year, nine South African universities have expressed interest in getting students to take part and some universities have confirmed the significance of the competition by including the design competition within their curriculum.

The aim of the PneuDrive Challenge has always been to create a platform for mechanical, electronic and mechatronic engineering students to not only be able to design and propose innovative engineering ideas, but to also bring together engineering theory and the latest technology in drive engineering and pneumatics. Throw into the mix the reality of compiling business proposals that are judged and analysed by industry experts, and South African engineering students have access to a learning experience that is unique in South Africa, if not the world. For more information, visit www.pneudrive.co.za.

ZEST WEG GROUP MIDDELBURG BRANCH INCREASINGLY FOCUSES ON ENERGY-REDUCING MEASURES

Charles Collen, Zest WEG Group's Middelburg area manager in the Middelburg branch warehouse.

The coal sector is being confronted by the same pressure to reduce energy costs as other mining sectors and Zest WEG Group's Middelburg branch is fielding an increasing number of customer requests to assess their mining operations and plants and recommend energy-reducing measures.

"We're very focused on supplying local coal operators with cost efficient energy solutions," Charles Collen, area manager Zest WEG Group Middelburg, says. "This area is home to some of the largest users of high voltage motors, most of which we supplied.

"Even though the Middelburg branch is only five years old, we've enjoyed some important early successes. For example, three large slip ring electric motors to Aquarius Platinum's Everest Project. These three 6 500 kW, 6 pole, 11 000 Volt WEG electric motors drive the mine's ball mills. A significant aspect of this project is that the motor driving the primary mill incorporates a slip energy recovery system. The variable speed control enables speed changes of plus 10% and minus 10% of the synchronous speed with the benefit of optimum milling efficiency being achieved.

"At Impala Platinum's Marula Project we've developed and commissioned custom designed electric motors. The scope of work was to supply two 4.6 MW 6 pole 11 000 V WEG slip ring motors for the mine's ball mills. The WEG motors were specifically built for this application and are electrically and mechanically interchangeable with similar motors already in use by Impala Platinum, to reduce the capital cost of holding a spare motor in stock at the mine."

Charles Collen and Michael Sill, internal sales administrator.

A B5 flange being fitted at the Zest WEG Group's Middelburg facility.

RASPBERRY PI

It is a single-board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard. It's a capable little PC which can be used for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition video. The design is based around a Broadcom BCM2835 SoC, which includes an ARM1176JZF-S 700 MHz processor, VideoCore IV GPU, and 128 or 256 Megabytes of RAM. The design does not include a built-in hard disk or solid-state drive, instead relying on an SD card for booting and long-term storage. This board is intended to run Linux kernel based operating systems. The foundation plans to release two versions; Model A & Model B. Model A will have 128 Megabytes (MB) RAM memory, one USB port and no Ethernet controller, while model B will contain 256MB RAM memory, two USB ports and a 10/100 Ethernet controller.

Though the Model A doesn't have an RJ45 Ethernet port, it can connect to a network by using a user supplied USB Ethernet or Wi-Fi adapter. As typical of modern computers, generic USB keyboards and mice are compatible with the Raspberry Pi.

AURECON MOVES UP IN 2012 GLOBAL ENR RANKINGS

Aurecon has moved up five places in the internationally recognised Engineering News-Record (ENR) Top 150 Global Design Firms 2012 rankings to occupy the 37th position in the world. In addition, the group maintained its rankings as number four in the Asia/Australia region and number three in the African region in the Top 200 International Design Firms rankings. Further, in two of the Top 10 markets, Aurecon is ranked twice in the top 10 – Industrial (seventh) and Manufacturing (third).

Since 2009, Aurecon has increased its ranking in the ENR Top 150 Global Design Firms listings from number 52 up to number 37.

James Watt was born in Scotland and because of his poor health as a child, he did not attend school regularly, but was mostly schooled by his mother. In his boyhood he was an avid reader, and found something to interest him in every book that came into his hands. He exhibited great manual dexterity and engineering skills, as well as an aptitude for mathematics, but the Classical languages did not interest him.

When James was 18 and whilst travelling to London to study instrument making, his mother passed away. On his return he settled in Glasgow where he was able to expertly repair the astronomical instruments of the University of Glasgow. He did not confine himself to scientific instruments, but made violas, guitars, fiddles, flutes and organs as well.

In 1759 his attention was drawn to the use of steam as a source of motive power. James experimented and studied the 50-year old, highly inefficient, Newcomen steam engine. The first engines had been used for pumping water from mines all over the country. James Watt realised that contemporary designs wasted a great deal of energy by repeatedly cooling and re-heating the cylinder. Watt designed a separate condensing chamber for the steam engine that prevented the enormous losses of steam. He joined the engineering firm of Matthew Boulton in Birmingham to start manufacturing his designs. The principal difficulty was in machining the piston and cylinder. The ironworkers of his day were blacksmiths, unable to produce equipment of any precision, which added to the problem. Through Boulton, Watt finally had access to some of the best iron workers in the world. Manufacturing a large cylinder with a tightly fitting piston was solved by John Wilkenson, who had developed precision boring techniques for canon making. Together Boulton and Watt began to manufacture their own design of steam engines, becoming the most important engineering firm in the country. Although the crank seemed the obvious solution for converting vertical motion to rotary, it had already been patented. Watt then invented and patented the sun and planet gear system to do the job in 1781. Initially Bolton and Watt supplied steam engines to the copper and tin mines, extending to the paper, flour, cotton and iron mills, as well as distilleries, canals and waterworks. His rotary engine revolutionised the process of weaving, spinning and transport. He invented a machine for copying sculptures.

In 1767 he built an attachment that made telescopes suitable for the measurement of distances (rangefinder). In 1788 he invented the centrifugal, or flyball, governor that regulated the speed of an engine automatically. This is of particular interest today, as it embodies the feedback principle of a servomechanism, linking output to input, which is the basic concept of automation. James Watt invented the pressure gauge in 1790.

Watt was also a renowned civil engineer, making several surveys of canal routes.

Boulton and Watt were elected fellows of the Royal Society in 1785. Watt was greatly respected by other prominent men of the Industrial revolution. He combined theoretical knowledge of science with the ability to apply it practically.

James Watt developed the concept of horsepower as a measure of energy. This allowed the output of steam engines to be compared with the power output of draft horses. The SI unit of power, the watt, was named after him in his honour. He also also invented the rev-counter. (The **watt**now magazine was also named after him!)

There was no good method of making copies of letters or drawings. Watt developed a successful copy process which was widely used into the twentieth century.

From an early age James Watt was interested in chemistry, and he developed successful textile bleaching systems.

By 1790 Watt had become a wealthy man, and after he retired in 1800 he focussed his energies entirely on his research work. He patented a number of other important inventions including the rotary engine, the double-action engine and the steam indicator, which records the steam pressure inside the engine.

In 2011 the Science Museum in London opened an exhibit of the original workshop (containing some of the 8434 objects found in it) of James Watt, who greatly improved the effectiveness of the Steam Engine, making the start of the Industrial revolution possible. James Watt has been described as one of the most influential figures in human history. wn

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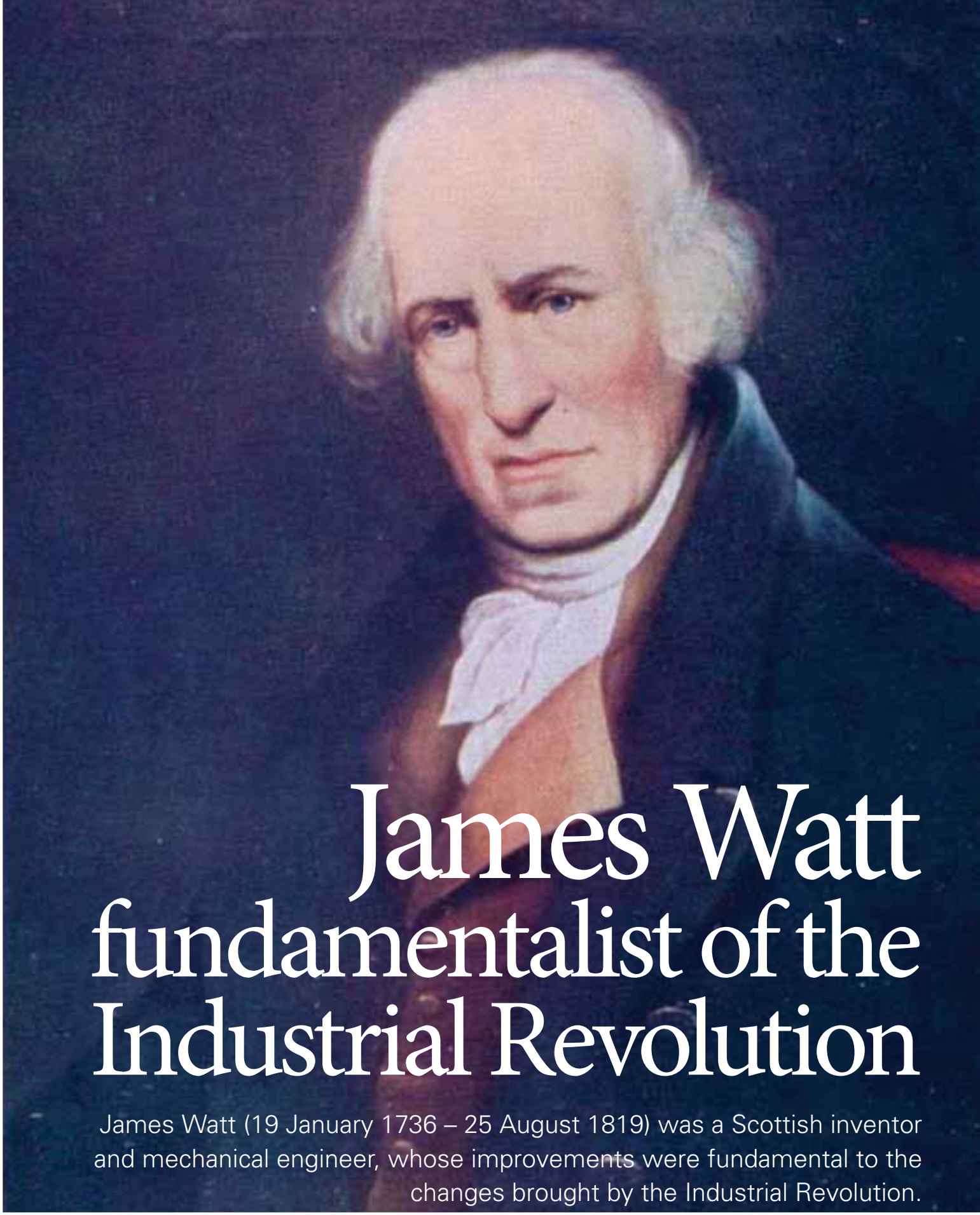

James Watt fundamentalist of the Industrial Revolution

James Watt (19 January 1736 – 25 August 1819) was a Scottish inventor and mechanical engineer, whose improvements were fundamental to the changes brought by the Industrial Revolution.

BY I DEREK WOODBURN **I** FSAIEE

Enlarged ACTOM group offers optimum balance of manufacturing and service support

ACTOM, South Africa's leading electrical engineering group, announced its acquisition of the Savcio (Pty) Ltd group in mid-February 2012, following approval by the Competition Tribunal South Africa.

The former Savcio group businesses are focused mainly on providing maintenance and repair services for rotating equipment and transformers throughout Africa.

The acquisition of Savcio boosts ACTOM's annual order intake to over R7,5-bln and increases the staff complement from 5400 to 7500. ACTOM is now the largest manufacturer, repairer and distributor of electro-mechanical equipment and provider of turnkey solutions in Southern Africa, comprising 42 operating units, 43 production, service and repair facilities and 36 distribution centres throughout Southern Africa.

ACTOM's strategy in acquiring the Savcio group was to counter the threat of imports by diversifying its range of businesses to provide a more balanced offering of manufacturing, service, projects and distribution.

Prior to the acquisition ACTOM's activities were weighted heavily in favour of manufacturing, whereas now the service component contributes about 40% of group turnover – well up from its former contribution of only 9%.

The resulting complementary offering of high quality manufacturing and service means improved all-round service to customers. *"We are now in the strategic position of being able to provide the product together with lifetime service and maintenance contracts,"* commented Mark Wilson, ACTOM's CEO.

"This all-in-one approach is in line with current trends in the marketplace, particularly in Africa, where most end-users want the assurance that the equipment they purchase is of proven quality and comes with full local service backup provided by people with the requisite skills and a sound track record."

The ACTOM group has for many years been unique in the electricity supply industry in South Africa in applying an undeviating policy of developing its local manufacturing and service capabilities at every opportunity and wherever such development is viable in terms of being sustainable. In addition it has sought to acquire other local businesses as a further means of developing group business and producing and offering more value-added products locally for sale into the Southern African market and beyond.

"Of equal importance have been the much needed job opportunities the group has provided and continues to provide to the local populace in applying this policy, in contrast to jobs lost – or more accurately never created – by companies who follow the simpler option of importing products required locally," Wilson said.

"At the same time we have provided invaluable opportunities for skills development and career advancement to our employees, as well as many other people employed by the numerous suppliers and subcontractors that form an integral part of our diverse range of business activities.

Our persistence in adhering to this policy has resulted in it gaining increasing endorsement and support in the local market – most importantly by Eskom and other major customers in the public sector. We are optimistic that this encouraging trend will continue and that it will win greater support in the future to the benefit of the country as a whole," he concluded.

ACTOM has built up an extensive resource of manufacturing and repair/refurbishment plants producing high quality and competitively priced products and services best suited to African conditions and a vast array of local expertise to match, while continuing to enjoy the benefit of access to world class technologies, products and expertise through its international technology partners.

The group has invested hundreds of millions of rand on expanding the capacities of most of its production, repair and service facilities in recent years. wn

www.actom.co.za

The largest manufacturer, repairer and distributor of electro-mechanical equipment and turnkey solutions in Southern Africa

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TO SUMMARISE THE IDEAS MENTIONED IN SOLAR POWER 101, PART 1:

- The Grid is your friend, but it needs some help:
  The intention is not to be independent of the grid, but to generate in parallel with the grid.
- The Grid is your friend, even though it is unreliable:
  If the grid goes down, the PV system goes down too, for safety reasons. If emergency power is required during power outages, it is recommended that another (cheaper) alternative is considered.
- The Grid is your friend, but it works for the government:
  Should a grid-tied PV system be considered, it is highly recommended that necessary approvals from authorities be pursued.
- The Grid is your friend, and it is a greedy one (I suppose it could be compared to a politician?):
  The PV system must be sized as such that the minimum excess power will be sent onto the grid if it is not used. Currently, although things will soon change, a customer will not be reimbursed for excess power pushed onto the grid. There are exceptions, of course. The right size will ensure that generated power will all be used by the facility and so reduce the energy bill.

LET US HAVE A LOOK AT AN EXAMPLE[1]:

The owner of a building enquired about a solar PV rooftop system. The faithful Solar Power 101 student will track the building down through Google Earth and have a look at it. At first glance it is noticeable that half of the building rooftop is not facing exactly north, but not too far off. This is a good sign! If this roof portion faced due east, due west or… gasp… south, it may not be possible to generate maximum power by employing this system. Again, as Solar Power 101 part 1 said, it is wise to generate as much as possible, thereby maximising Return on Investment (ROI). After all, money makes the world go round!

During Solar Power 101 in the June 2012 issue of **watt**now, a few ideas about rooftop mounted solar PV (photovoltaic) systems were discussed without getting into the practical side of things. It was the intention of the article to shed a (possibly sobering?) glimmer of light onto the subject.

Figure 1 -- Google Earth image

[1] *A random building was selected. All values are fictitious and are for illustrative purposes only.*

SOLAR POWER 101

"The Grid is your friend" *part 2*

BY | THINUS VAN AS
Pr. Eng. **|** B.Eng.(Stell.) **|** M.Sc.Eng. (Electrical Engineering)(Stell.) **|** M.SAIEE

SOLAR POWER 101

"The Grid is your friend"

continues from page 21

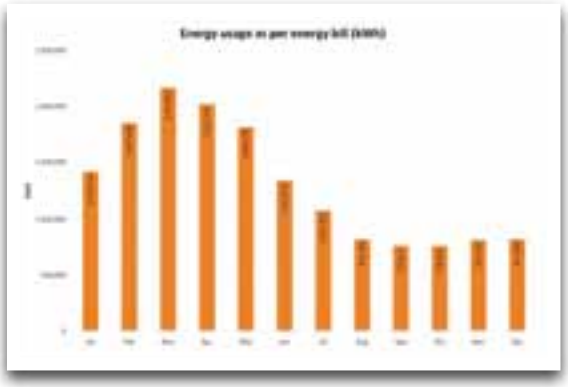

Figure 2 -- Energy usage [kWh]

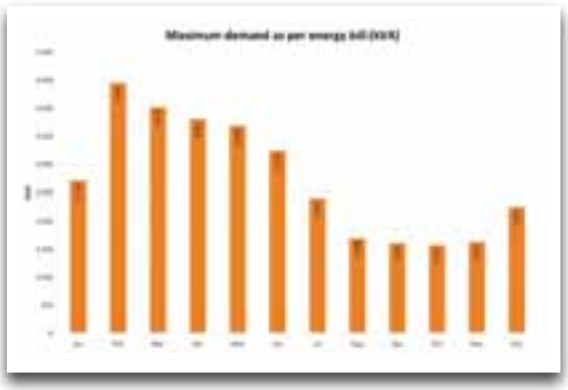

Figure 3 -- Maximum demand [kVA]

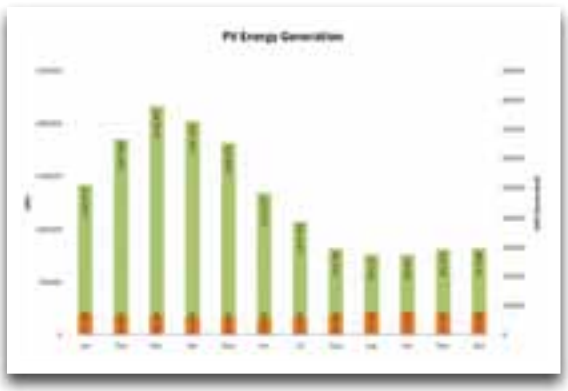

Figure 4 -- Consumption versus generation [kWh]

At this stage it is wise to have a good idea of which solar PV module will be specified. It is not the intention of this article to open a can of worms (or is that an ingot of silicon?) and enter into a debate about thin-film versus crystalline versus poly versus mono versus...(you get the picture, but nevertheless, let us carry on). It is now possible to calculate that the roof is big enough to fit 500kW of solar PV modules. The system shall therefore have an "installed power" of 500kWpeak.

Next, scrutinise one years' worth of electricity bills for the following information:

1. Monthly energy consumption (kWh or MWh)
2. Monthly peak power demand (kVA or MVA)
3. Price of one unit of energy (R/kWh)

Seeing as the information will be presented in a report or proposal to the client, it may be worthwhile to create a spreadsheet and some graphs:

FIG2 - ENERGY USAGE

The energy usage information will assist in indicating to the customer what percentage of consumption they can expect to be generating with the proposed system. Next, the maximum demand of the building will indicate what the maximum size of the system should be:

FIG3 - MAXIMUM DEMAND

According to the graph, the maximum demand of this facility is around 1,5 MVA, and the installed system can, but probably won't, peak at 500kVA (depending on the power factor). This is a good indication that even in the months of low peak consumption, excess power won't be wasted. Of course, power not used on weekends will be injected into the grid, for free. This can be thought of as collateral damage, tax or possibly giving those pesky neighbours bread and water when they arrive unannounced for Sunday lunch. Maybe they'll get the message, eventually.

Next, the solar irradiation of the area and the roof, at a particular inclination angle, must be assessed. It is recommended that a reputable software package with up-to-date weather information be used. These types of software packages employ historical weather information, so the more data they have to base the calculation on, the better. The important information we are looking for is how many kilowatt-hours will be generated by this particular system, at this particular location. In a different location, the same system will generate a different amount of electricity.

A popular solar resource assessment application estimates that this particular 500kWpeak system could possibly generate 814 MWh of electricity during the course of the first year of production. When the information is placed onto a graph along with the energy consumption of the building, it looks like this (green

indicates consumption, orange indicates generation):

FIG4 - CONSUMPTION VERSUS GENERATION

By using the above-mentioned information, it is possible to calculate the CO2 emissions that will be saved by this system. This is often only used as a marketing tool, but it is nevertheless very important to know. Every country will have a different "generation index" as far as CO2 is concerned (see http://www.iol.co.za/business/opinion/sa-s-reliance-on-coal-fired-electricity-costs-too-much-1.693489?ot=inmsa.ArticlePrintPageLayout.ot). For South Africa, 1.03 tons of CO2 is needed to generate 1MWh of electricity.

In order to have a good estimate of what the peak power output of the system will be at any given moment, a system simulation will have to be performed. It is not critical to define this, but the grid operator or customer may wish to know what the expected value, in kW or MW, will be. The distribution board where the system will be connected may also have a limit regarding maximum power flow.

On the financial side: It was calculated, from the utility bills, that the client pays an average of R0,89 c/kWh and will therefore save around R724 000 in the first year of PV production. Remember that this cannot be guaranteed because the weather will do as it pleases. PV production and weather monitoring systems will tie production and weather information together so that an under-performing system could possibly be vindicated should the year have less sunshine that normal.

Back to financial calculations: To calculate the time it will take for the system to pay for itself, one needs to know what the yearly degradation of the system is estimated to be – this calculation will work against the sale, but it is sufficiently small to not have a massive impact on the repayment period. Another parameter required for this calculation is the estimated energy price increase for the next decade or so. Again, these increases cannot be guaranteed, so it is important to explain to the customer where the values come from. It is highly recommended to use a credible source and not over-estimate in order to push the sale.

Add to this any possible incentives by our favourite government tax collector (there really are some!) as well as our favourite utility (yup, those are available too – really!), and you should arrive at a payback period of around 6-8 years. Of course, the less the customer pays for electricity, the longer it will take to repay the expenditure on this system, because the savings are equal to the power generated by the PV system, as it is power used, but not "paid" for as far as the utility is concerned. It is also important to mention that these calculations assume the project will not be funded by a debt-provider. Should this be the case, factors such as Return on Investment (ROI) and Internal Rate of Return (IRR) must be considered during the investment decision.

If the customer has the financial means and is happy with the payback period, a glass of champagne is in order. If the customer does not feel like popping the bubbly just yet, it may be explained to them that PV systems are scalable and the system may be smaller to begin with and expanded on at a later stage.

The savings should be linear, on average. At least the client will be able to save money from the get-go, even with a smaller system.

In Part 2 of Solar Power 101, some basic principles regarding the practical steps of rooftop solar PV system design were discussed. The successful student should be able to assess a building for a rooftop PV system as far as suitability, size, solar irradiation and financial viability is concerned. wn

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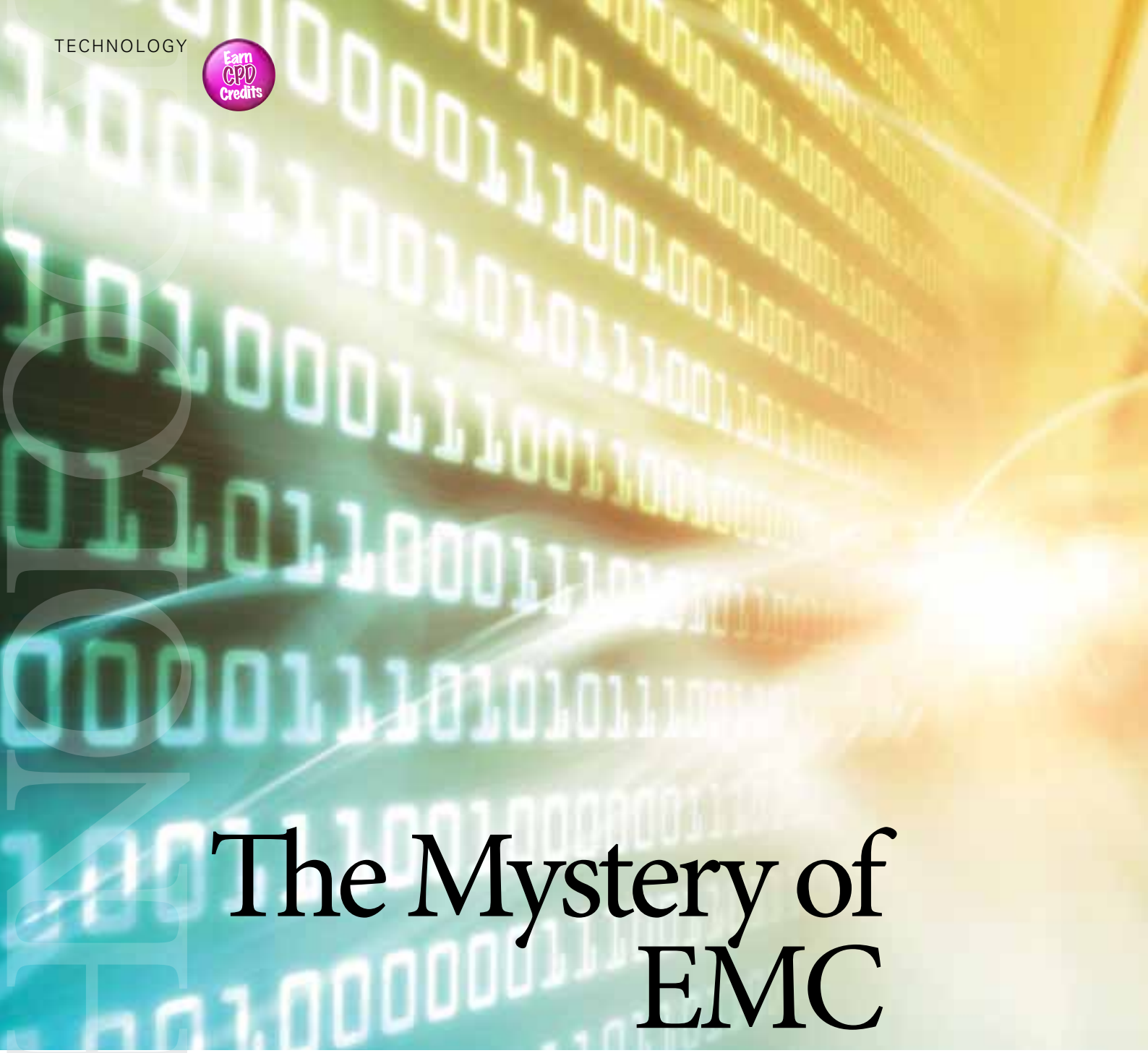

The Mystery of EMC

Ask electronic engineers what they think about EMC, most will reply "A black art", "A pain in the neck" or "Unnecessary complication". Sad, really, because without an eye on this subject, your mobile phones, TV sets – for that matter, most devices incorporating receivers – would not work, (due to emissions) or non-radio devices could fail when excited by external electromagnetic phenomena. Really bad news for anyone living in today's technology-rich society.

BY | ERIC WINTER | M.SAIEE

Until the late 1970's, most electronic equipment was analog in nature, and there was an inherent understanding of the risk of interference by design engineers. Since then, however, the "digital age" has landed, and today's design engineers focus their efforts on the digital regime. They are good at looking at the design requirements based on a time line, and have lost sight of the implications of the "Fourier facts", a fast rise time can only be achieved by wide bandwidth requirements.

Another effect of today's technology development is that of device speed. There is a tendency in many electronic engineers' minds, to think "use as fast a processor as possible". Here again, we have the problem of an often unnecessarily wide bandwidth requirement, since the appliance spends most of its' time waiting for a human to push a button. One must ask the question, "Do you really need microsecond accuracy for a washing machine, a video decoder, a pool pump controller or an intercom?"

Printed circuit layout is rarely done with an eye on the EMC implications. In particular, clock lines are often distributed in patterns which act as antennas. In addition, high current drive lines such as memory and I/O control can give rise to unexpected problems. Software can also influence emissions, in such cases as when the status of an I/O line is repeatedly interrogated, giving rise to an emission which is very similar in nature and level to those caused by clock lines.

An all-too-common mistake is a fundamental error at the initial concept stage. One should very carefully consider all of the options of the design and their implications before choosing the first component. An example of this will illustrate the problem – high-power servos need to be driven from a remote control site. The two obvious options are to house all of the control gear, including the servo drivers, in the control centre and run the high-current servo drive through long cables, or to run power (AC or DC) through the heavy cables to the servo drivers next to the servos, along with the servo command and control cables, low current. The first choice would obviously result in very high emission levels, which can be reduced, but needing significant added cost. The second could result in emissions from the control cables, but these would be significantly easier to correct.

SOME SOLUTIONS

There are three possible routes to the correction of an EMC problem-

- Redesign (of part or the entire system) is a rare opportunity, since marketing time scales are normally perceived as being of overriding importance. However, the design engineer should, in the very early project stages, allow for this possibility in estimating design time. (If no redesign is necessary, the time gained is certainly in the interests of both the company and the engineer).

- Local area attention usually takes the form of added passive components. Resistors and/or capacitors are used to slow down the sharp edges, or to reduce the effects of a resonance. Inductors and ferrite components generally act as low-pass filters. This approach is applied with minimal or no PC board changes, but should only be used as a "stop-gap" measure, and a more technically sound solution should be sought when a new version is produced.

- Containment is very convenient in products which must be "ruggedized", such as military stuff – in other words, "wrap it in metal". It is regarded by most EMC experts as a bad excuse to get around the problems which arise from poor EMC design. That said, if one is faced with a time constraint, this is sometimes the only way to get a product into the market. It must be said that it is certainly possible to achieve full EMC compliance for most complex systems without resorting to a shielded enclosure, but the effort required to achieve this may not be economical. Run out of time? Accept the inevitable product cost, along with other negative issues such as weight and process time.

Of course, the best approach to assure EMC compliance is to take the various requirements into

The Mystery of EMC

continues from pg 25

consideration at the start of a project, not at the end at test time, when one is probably short of time and finance. At the very least, the project leader should consider the end product from the point of view the end user, to establish the negative external factors which could degrade the product performance.

In this regard, one must consider what worst-case phenomena may reasonably occur, and make sure that these are borne in mind throughout the development stages. The most commonly-failed test is that of Electrostatic Discharge (ESD), which can be generated by a person walking on a modern synthetic material in a dry environment. Remember, please, that any surface which can be touched is "fair game" for the application of the ESD gun. Other common tests are short-duration power failure, surges caused by other machines in the vicinity switching on or off, RF energy from mobile phones and two-way radios, and power "brownouts".

FIXES

The EMC engineer has a range of measures which are applicable in many conditions; here are some of the most commonly used on "finished" products:

- The part of a system or device which is most likely to give both emission and immunity problems is the cable(s) which connect it to the outside world. One fundamental rule is that a pair of conductors will not act as an antenna (transmit or receive) if it is balanced and matched (impedance). Take care to ensure that the cable matches both the source and load impedances.

- Another consideration arising from the previous one, is that if one has a pair of conductors, twisted, one of which is earthed (unbalanced), is VERY likely to give EMC problems. The most common occurrence of this is the widely used (and widely-misused) ITU-T standard, G703. The wording appears to allow a balanced cable to be used on an unbalanced source or load circuit, which is not the intention.

- Bad grounding is probably the most common cause of EMC test failure, and there are many schools of thought as to how to approach each one. One should try to separate the circuit types from one another to reduce interaction, but this is sometimes difficult to achieve. The circuit types to consider separately are audio, RF, digital, analog, relay, high-current and lightning. Some are easy and obvious, but the others – well, that's why there are EMC consultants!

- Ferrite tubes, rings and clamps are tricky to use correctly, take a look through a manufacturer's data book to see how difficult it can be. A quick way to do the job is to have a range of sample ferrites, from which the best can be selected. There are, however, some simple rules for those who don't want to get too involved, such as "The more mass in the ferrite sample, the greater the attenuation", "High-loss ferrites are usually required for EMC work". Whichever ferrite you choose, the "best one is the one that works best". However, don't expect too much. One can only expect between 5dB and 10dB attenuation maximum for a wire passing through a single ferrite clamp. Not much, true, but it could be enough.

- Expanding on the previous statement, try a single ferrite with multiple turns. 5dB per turn, 10 turns, now, maybe, we're getting somewhere.

- Shielding, local or around the entire product can make the difference between pass and fail, and can sometimes be added at the end of a project. Metallic can work well, but don't expect too much from carbon-loaded aerosol spraypaint.

STANDARDS

The first organisations to recognise the risks posed by EMC were the various military formations. From these we get the MIL STD 461/462 (USA) and the various DEF STAN (UK) documents. Happily, most design engineers don't have to build a "mouse to MIL STD".

In the world of the ordinary citizen, the risk to the radio services was recognised in 1934, and the first serious attempt to define the degree of was risk for commercial and domestic products, CISPR was born. The table below shows the frequency ranges of the earliest CISPR standards I have. These are no longer available, or supported by CISPR, but remain valuable historical documents.

CISPR number	Edition & date	Frequency range	Products
CISPR 1	Ed. 2, 1972	500kHz to 30MHz	All
CISPR 2	Ed. 2, 1975	25MHz to 300MHz	All
CISPR 3	Ed. 1, 1975	10kHz to 150kHz	All
CISPR4	Ed. 1, 1967	30MHz to 1000MHz	All

These standards contained all of the information for measuring emissions, including receiver specifications, test setup, calibration data, certain product tests, etc.

Since then, the various aspects of testing are contained in separate standards and sub-sets. The most common of the CISPR standards are CISPR16 (in 4 parts, 14 sub-parts) which describes test equipment and setups, CISPR11 which addresses the requirements of ISM (Industrial, Scientific and Medical) equipment, and CISPR22, for Information Technology equipment. CISPR22 is in the process of being replaced by CISPR32, for Multimedia. For a full list of CISPR and IEC standards, use the facility www.iec.ch. (The commercial immunity standards are in the IEC61000 series).

In the early 1980's, the IEC started work on the immunity (susceptibility) of products, and we now have more than 35 separate standards for immunity requirements. These include ESD (Electrostatic Discharge), Burst and Surge, Interruptions, Lightning, RF injection (both conducted and radiated), and many others.

ICASA, SABS and contributing engineers have now agreed on EMC standards for ALL electronic equipment for type approval in South Africa. This list can be obtained from ICASA, or downloaded from my web site www.emcassist.co.za

ACRONYMS

CISPR is the French acronym for the "International Special Committee on Radio Interference".
EMC – Electromagnetic Compatibility
IEC – International Electrotechnical Commission

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Automated Metal Stamping

A large automotive metal stamping plant in the United Kingdom (UK) processes thousands of tons of sheet metal each year to supply door and side panels, hoods, and chassis parts to its manufacturing and assembly plants throughout Europe. The stamping plant consists of 8 automated transfer press lines and associated machinery such as conveyers, handling machines and scrap process. Each press line stamps components for a different vehicle model and has its own dedicated supply transformer operating at 415 V 50 Hz.

BY | BOB SEAGRAVE **|** PR.ENG

Stamping machines generate high levels of active (kW) and reactive power (kVAr) consumption during their normal sequence of operation. The power consumption is dictated by three main variables; the downward pressure that needs to be applied to the sheet metal being processed, the grade (thickness) of the steel, and the upward pressure required to release the stamping die from the block. When there are multiple press lines operating in the same locale, serious disturbances on the electrical network can be caused that affect other manufacturing processes within the plant. Further, these disturbances may impact other consumers that are sharing the same local electrical distribution infrastructure.

In this particular installation, the supply transformers were under stress, as continuous and simultaneous operation of all press lines was resulting in high reactive power (kVAr) and apparent power (kVA) consumption. This continuous large power consumption was leading to transformer overloads and over-heating. The presence of harmonic distortion contributed to further heating, and meant that some transformers were operating above 100 degrees centigrade (212°F). This case study presents before and after measurements of one press line from this installation, which has an Elspec Equalizer dynamic power compensation system rated at 785 kVAr. This system is tuned to filter 5th order harmonics, and is connected directly to the press line's supply transformer, operating at 3-phase 415 V, 50 Hz.

TRANSFER PRESS LINE LOAD PROFILE

The Press line idles at a very low load level, <10kW per phase, however when the stamping process begins the power levels fluctuate dramatically. Typically the load increases from less than 10 kW per phase to 400 kW to 420 kW per phase within 3 to 4 cycles, (60 – 80 ms @ 50 Hz, 50 – 67 ms @ 60 Hz), and that peak consumption is then maintained for 4 to 5 seconds. The dynamic load fluctuations re-occur continuously every 7 to 8 seconds during a normal stamping run.

Figure 1 is a 2-minute sample that graphically depicts a typical power profile of a normal batch process on

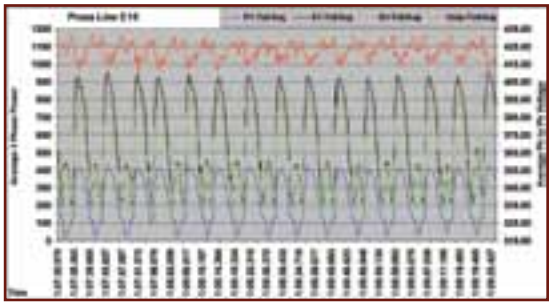

Figure 1 – Press Power Profile (2 min)

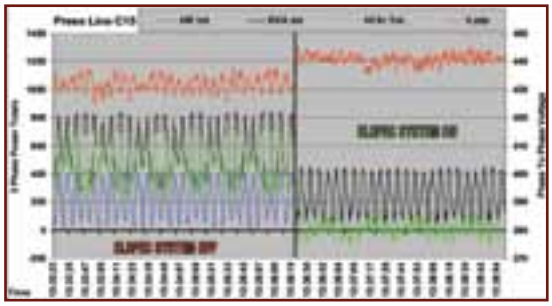

Figure 2 – Before & After Results

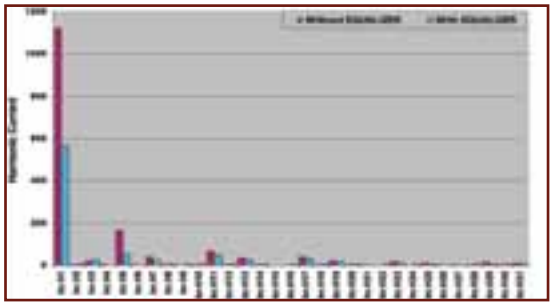

Figure 3 – Harmonic Current Reduction

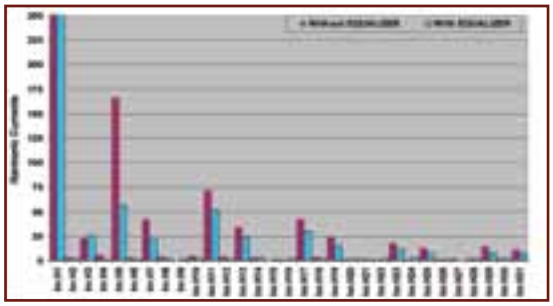

Figure 4 – Harmonic Current Reduction

Automated Metal Stamping

continues from pg 29

the press line. The graph demonstrates that power consumption fluctuates dynamically, with reactive power (kVAr) varying by as much as 650 kVAr each stamping cycle. Ultimately, these reactive power fluctuations result in unacceptable degrees of voltage modulation (sag) and high-energy consumption. Eliminating or reducing these reactive power demand peaks is essential if voltage stability is to be attained.

THE EQUALIZER DYNAMIC COMPENSATION SYSTEM

The Elspec Equalizer system is specifically designed to compensate for this type of dynamic load with high reactive power consumption. Using electronic switches (SCR/SCR) and sophisticated control algorithms that consider True Power Factor (PF) while taking into consideration all harmonics up to and including the 63rd harmonic order, it calculates and responds to reactive energy demand (kVAr) within less than 1 network cycle (<20 ms @ 50 Hz, <16.7 ms @ 60 Hz).

In this instance, a system rated at 785 kVAr was installed directly at the press line transformer. The system consists of 6 x 131 kVAr capacitor groups tuned to the 4.7th harmonic to reduce the impact of the 5th harmonic during the peak demand.

As Figure 2 demonstrates, the introduction of the Elspec system has a dramatic effect on the power consumption recorded at the press line supply transformer. Apparent power (kVA) consumption is reduced by nearly 50%, indicating the effectiveness of Elspec's Equalizer system in reducing the peak reactive power demand. The average 3 phase voltage (ptp) also shows an improvement of +2.5%.

HARMONIC MITIGATION

The press line's speed and process controls generate relatively high levels of harmonic current distortion. This harmonic distortion is a major contributory factor to the supply transformer's high operating temperatures. Although the main contributing harmonic is the 5th (H5), the overload of the supply transformer results in the amplification of all harmonics recorded, up to and including the 31st order.

The following table, Figure 3, illustrates the measured harmonic spectrum recorded during peak load conditions both before and after the Elspec Equalizer was installed. It is clearly evident that harmonic currents are present at nearly every harmonic frequency up to and including the 31st order, although the intensity at higher orders is lower in comparison.

When all harmonic currents are taken into account in conjunction with the fundamental current, these press lines have a low power factor. This means there is significantly more current flowing in the stamping plant's power system than is required to 'get the job done.' This increased current can also lead to higher cabling losses per kilowatt of connected load.

It is evident that the Elspec Equalizer has been successful at reducing the harmonic impact of not only the targeted 5th harmonic current, but also has effectively lowered the harmonic current on each harmonic order. Figure 4 features a zoomed view of Figure 3. It offers a much clearer picture of the degree of harmonic mitigation achieved during the press line's peak operating conditions.

As Figure 4 shows, all significant positive and negative sequence harmonic currents have been mitigated when the Elspec Equalizer system is operating. The fifth harmonic (H5), potentially the most damaging, has been reduced from 167 A to only 55 A (nearly 70% reduction).

PERFORMANCE OF THE OVERALL INSTALLATION RESULTS:

Metal stamping plants throughout the world are realizing the benefits of real-time reactive power compensation. By installing Elspec's Equalizer system, these facilities have improved voltage stability, lowered maintenance costs, increased service utilization of their transformers, achieved harmonic current reductions, decreased power system losses and reduced or eliminated power factor penalties.

This installation of an Elspec Equalizer system yielded the following specific performance results:

- Load current on each press line is reduced nearly 50% (from 1150 A to < 570 A);
- Average voltage on each transformer was raised by approximately 2.5% (10 V);
- Reactive power (kVAr) consumption significantly reduced from 245 kVAr per phase to < 50 kVAr, improving power factor to an average of >0.95;
- Maximum Apparent power (kVA) demand lowered by over 45% (from 840 kVA to < 450 kVA);
- Due to increased voltage, taps were reduced yielding a billed kWh consumption savings;
- Increased transformer utilization (more load could be added;
- Reduced operating temperature of transformers and plant electrical system (lower losses);
- Lower total energy costs;
- Electrical-related downtime was reduced. wn

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The answer to Rubber Recycling

SAVE ENERGY, CUT POLLUTION AND DECREASE COSTS USING OXYGEN ENRICHMENT AND CRYOGENICS FOR RUBBER RECYCLING

South African companies involved in using or producing recycled rubber products can look forward to becoming more environmentally compliant, while at the same time saving on production costs.

BY I KENDAL HUNT

According to Sachin Kulkarni of Bulk Gases, an industrial and specialty gas products and chemicals company, the evolution of oxygen enrichment for cement kilns and cryogenics for rubber recycling companies, is extremely beneficial to industry.

"These rubber recycling methodologies are finding increasing favour with companies who seek ways of reducing their carbon footprint. At the same time, they benefit from decreased operational costs and a higher profit margin," Kulkarni explains.

BURNING RUBBER

Kulkarni says that oxygen enrichment evolved when cement producers sought alternative fuels to the expendable and non-renewable natural resources, such as coke and coal, for use in the cement kilns.

"They researched many options, such as waste fuel and solvents. However, the noxious fumes derived when heating these substances using traditional methods in the kilns was considered detrimental to the environment and humans," Kulkarni points out. Ultimately, the dilemma is one of energy versus emissions.

"One of the alternative fuels the researchers considered was waste rubber. In the late 1980s, oxygen enrichment was adopted as the ideal methodology for achieving full combustion when re-using rubber as a fuel in cement kilns. Due to the fact that oxygen enrichment allows high temperatures to be reached very quickly, the impact of emissions is drastically reduced, while at the same time producing the requisite amount of heat required for the cement manufacturing process," Kulkarni explains.

The heat produced is so intense that it effectively removes all nitrogen from the process.

While oxygen enrichment is now commonly used in cement kilns which utilise recycled rubber as a fuel, Air Products' burner system has evolved to a stage where its optimised design allows for complete process stabilisation and maximised output.

"Air Products' expertise and experience with burner technology has been carefully developed and honed in multiple applications worldwide and our systems are considered to be huge contributors to the ongoing stewardship of the environment," Kulkarni adds.

The return on investment of an oxygen enrichment system is excellent. Companies adopting this

methodology would require an oxygen burner, an oxygen flow meter and NOx monitoring equipment, which monitors flue gases, to adequately decrease or increase oxygen flow.

"There are three different types of oxygen enrichment – low, medium and high – which vary the rate between 1 and 4%," says Kulkarni.

Documented benefits include an increase in clinker production of between 5 and 30%; an increase in usage of alternative fuels (such as rubber) of 30 to 80% and improvements in kiln stability.

THE 'BIG FREEZE'

In addition to its expertise in the field of oxygen enrichment for cement kilns, Air Products has established a footprint as a supplier of superior products for the cryogenic recycling of rubber.

Kulkarni explains that in the late 1970s there was a global move to partially replace pure rubber with approximately 1.5% latex rubber in products. This initiative was one of the early motivators to consider the effects that industry has on the environment, and to find alternatives to the use of non-renewable resources.

In a complementary manner, as the demand for more finely ground recycled rubber increased, the incentive to find more productive and economical ways of achieving this gained momentum. *"The primary problem with grinding rubber into very fine particles is that it is very malleable. In order to reduce its malleability and give it the characteristics of a harder substance such as glass, it was necessary to temporarily change its inherent form,"* says Kulkarni.

By applying cryogenic principles to the handling of the rubber, industry has been able to alter the form of the rubber so it becomes extremely brittle and, therefore, easy to break and grind.

The first step in the process is the removal of all foreign objects, such as wire and nylon from rubber tyres and other waste rubber. Thereafter, the rubber is chopped up into manageable chunks and is placed on a sealed system conveyor. Liquid nitrogen is sprayed on the rubber until it reaches glass transition temperature levels. Following this process, the rubber can be removed for fine grinding.

The resultant powder is used as an additive for tyre manufacturers, rubber parts suppliers, on airport runways and in the sound-absorbent rubber mats at airports.

"Research indicates that increases in throughput levels of up to 100% have been noted when maintaining the same particle size distribution achieved with ambient temperature methodologies. Similarly, finer grinding can be achieved if one uses the same throughput levels," says Kulkarni.

The benefits derived from using cryogenic technology in this application include reduced power consumption, increased usage of waste product, less impact on the environment and increased return on investment. wn

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The Zest WEG Group has supplied electric motors to the South African market for more than 30 years and, today is considered the leading supplier of low, medium and high voltage electric motors, variable speed drives, softstarters, switchgear, transformers, MCC's, containerised substations, diesel generator sets and co-generation and energy solutions as well as electrical and instrumentation engineering and project management services in Africa.

ZEST
WEG Group

A series of acquisitions over the past six years has seen it become a complete solutions provider on projects across Africa, and this was underscored when WEG of Brazil took a major shareholding in the Group in mid 2010.

Zest WEG Group CEO, Louis Meiring, says that in recent years a number of established companies were identified as providing products and services that had clear synergies with those of Zest. These were acquired to provide customers with a complete packaged solution.

IMS MEETS STANDBY POWER DEMANDS

In 2005 specialist generator manufacturer IMS Cape was purchased and as a result of increased demand for standby and permanent power significant investments have been made in the company, including the move to a larger factory in Epping. IMS has a large installed base of gensets in the Western Cape and this footprint is steadily being expanded in the rest of South Africa.

MAJOR EXPANSION COMPLETE AT SHAW CONTROLS

Six years ago, Shaw Controls of Johannesburg was acquired. Established in 1981, this company manufactures motor control centres (MCCs), distribution boards, control desks, PLC panels, instrumentation control panels, portable container substations and various other electrical panels.

More than R30 million has since been invested in the business gearing it up for further growth in South Africa and the rest of Africa. During 2011 and 2012 the facility in Robertsham was expanded into a single 10 000 m2 site housing a 1 000 m2 in-house container conversion yard featuring a 25 ton overhead crane. Projects in Africa are faced with huge logistical challenges and the ability to provide containerised MCCs and sub-station solutions stands it in good stead in Africa.

FULL SERVICE PACKAGES WITH EnI ELECTRICAL

In 2009 Zest moved beyond the supply of equipment when it acquired a controlling share in specialist electrical, instrumentation and control engineering company EnI Electrical, which carries out procurement, design, control, installation and commissioning on the electrical and instrumentation elements of projects and supplies the cabling, racking and associated ancillary services.

ZEST ENERGY POWERS AHEAD

The most recent acquisition was Zest Energy, which joined the group in mid-2009. Initially involved in the supply of diesel generators, Zest Energy now provides solutions in the areas of heavy fuel oil generators, gas engines as well as steam turbines and co-generation projects. The energy company can also supply complete MV and HV sub-stations.

STRATEGIC ACQUISITIONS GROW MARKET SHARE

Zest WEG Group's strong growth in recent years is a result of these strategic acquisitions. The synergy between the product and service lines of the various companies means that the Group can provide a complete solution for its customers' needs. This cohesive team is able to harness its diverse skills, resources and expertise and add significant value to customers' business and projects. wn

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Lightning Risk

Risk has become an increasingly pervasive concept in human existence [1]. The perception of risk is more often what affects the understanding of how risky a scenario is rather than the calculated value of the risk. This could be as a result of a couple of things.

BY | ANDREW DICKSON

Either the calculations are not fully understood, or the results obtained have little meaning. Alternatively, people through their experiences, social interactions or access to information, are redefining their tolerable limits to risk. This means that, regardless of what the calculated risks are, the willingness to participate or be present in a dangerous scenario is not seen as excessively risky.

It is therefore assumed that risk can be managed through human intervention. This does introduce the idea of responsibility and blame for any risk scenario.

There has been an increase in public awareness, particularly with the introduction of such concepts as occupational health and safety [2].

In the past engineering design was performed with little regard for life. The concept of the design outweighed the necessity to rationalise the process and final outcome of the design. In line with economic pressures and general improvement of public awareness, has grown the increased requirement to introduce public safety in designs. Thus the social revolution of understanding the basic concept of risk, and the need to address it on a day to day basis has also grown.

The International Electrotechnical Commission (IEC) consolidated the lightning protection standards into a confined suite of documents with the generic title of "Protection against lightning". These documents were released by the IEC in 2006 and were made possible through the present

understanding of lightning phenomenon. Each standard looks at a specific area of lightning protection. There are currently four parts in the suite [3-6] and the second part IEC62305-2:2006/SANS62305-2:2007 looks at the risk management of lightning.

The document classifies four different types of risk. These are the risk of loss of human life, the risk of loss of service to the public, the risk of loss of cultural heritage and the risk of loss of economic value. Consideration during this article is given primarily to the risk of loss of life.

The realistic perspective defines risk as being the probability and consequence of an adverse event. This is the method used in the SANS62350-2 and the generic formula is shown in Eq. 1. For each risk type there are a number of risk components that are summed in order to obtain the total risk for any given scenario. These risk components are derived from the different sources of damage, being typically being direct or indirect lightning flashes.

$$R = N\ P\ L \qquad [1]$$

Where "R" is the total calculated risk. "N" defines the number of annual events. This factor relates to the collection area of the object being investigated, the relative surroundings and the lightning ground flash density. "P" is the probability that an adverse event will occur. This factor relates primarily to the electrical characteristics of the installation, including the existence of any installed lightning protection measures. The level of protection and the physical requirements are laid out in the other protection against lightning standards. "L" is the consequential loss as a result of an event occurring.

International collaboration as well as international conferences such as the International conference on lightning protection (ICLP) have developed the general understanding and processes involved in creating these standards. Due to the international collaboration the standards ultimately represent the norm. What is the process to be followed if a scenario falls outside this norm? Should it be a case that the standards are "tuned" per country, or does it need to be more specific than that. Furthermore, are there methods of doing this without changing the meaning of the risk analysis? Who would take responsibility of this and define these changes?

An understanding of risk should first be addressed. This is managed through the risk management standard and is referred to as the "tolerable risk". In the standard the tolerable risk is defined as 1 10-5 per year, but the standards do state that 'It is the responsibility of the authority having jurisdiction to identify the value of tolerable risk' [3]. Therefore, if deemed appropriate, the local standards body can change this value. For the present the validity of the number is not under consideration, but more the meaning of the current value.

The originally stated value is not in a format that provides much meaning, however, the value can be stated as 1 in 100 000 years. Considering that the life expectancy in South Africa is 54 years, this value still has little meaning. Another interpretation is to say 10 deaths per million people per year. This is a value that can be understood by the majority of people and therefore could be used as a basis for a comparison. This raises the question of wether any deaths per year as a result of lightning should be accepted. To reduce the value to zero would be extremely difficult, but what if one were able to target reducing this value by 90%. The present day understanding should surely make this possible, however, the diversity seen in South Africa may not make this possible.

There is an increasing social awareness with respect to many activities and disciplines. The phrase socio-cultural perspective has begun to gain a greater acceptance and recognition in terms of risk. Due to the social diversities seen around the world, these diversities have an increased effect on any risk analysis process. As the name suggests the term has been derived from social anthropology and cultural geography.

There are certain aspects of the current risk management standard that do consider certain geographical features in determining the risks associated with lightning. However these primarily pertain to the "N" component of the calculation, which describes the collection area of a structure being investigated. Being able to identify the probability of the event, as well as the subsequent losses, becomes more difficult as in many cases since there are no norms. An additional component that needs to be considered is more along the lines of the secondary effects. For example, if an informal township is considered and a fire should break out in one of the structures, what is the likelihood of additional nearby structures being affected by this fire?

Due to the proximity of the structures to each other the secondary effects would be quite high. If the same scenario is applied to a typical residential area in an urban environment, a fire would only typically affect the immediate structure.

Lightning Risk

continues from pg 37

In the same manner the social impact of a loss of life may vary considerably and have far greater reaches in different social circumstances. Besides the obvious emotional grief, the economic impact of the primary income earner being killed in the case of low economic groups could have a far-reaching effect. There is often a sole earner and the number of dependents can be high. This value is very difficult to quantify but the potential social implications are large.

In most reported cases of lightning related deaths, the victim has been in an open area. These are typically areas of veld, open sports areas or exposed mountainous regions. The safety of individuals might therefore be more of an education policy need than a push for better risk assessment techniques. There are many people in this country who can ill afford to delay travel time, as the journey is often too far, and the time required too long.

However the alternative can be costly for all parties concerned. This primarily affects more of the disadvantaged community but is not limited to that social group. Education of people is important but this needs to also be performed in line with social understanding and cultural beliefs, otherwise little would be gained by this. In addition, wider education of sport facility management, schools sports directors and coaches, who unknowingly place people at risk from a lightning flash is needed. All these ideas contribute towards reducing the number of deaths that occur from lightning each year.

The traditional methods of performing a lightning risk analysis can be classified as the realistic perspective. This has provided a good indication as to the lightning risks, and therefore the necessity to install lightning protection. These methods only seem to hold true for the lightning risk analyses of commercial, industrial and conventional urban structures.

A different dimension of risk analysis may be necessary to evaluate risk for the diverse social and cultural groups found in South Africa. By introducing the socio-cultural perspective into an analysis it provides a truer understanding of the risks which may be achieved.

The problem with trying to apply this, is the process of being able to quantify social parameters that can be correlated to some analytical value for the assessment. This begs the question of whether it is possible to standardise such a process, or should each scenario be assessed based on its own parameters.

A lightning risk assessment aims to mitigate the effects of a lightning flash, however, are all the bases covered? It may be necessary in the future to consider broadening the scope of the risk assessment techniques to include parameters derived from a socio-cultural perspective. wn

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Hyperbolic systems measure differences in phase or differences in the times of arrival of radio signals at spaced stations in order to locate their sources. It was known that lightning emits a very wide spectrum of radio signals. Even those flashes that are hidden by rain or cloud can be observed using radio. I installed four receiver stations on high ground around Johannesburg so that they formed a pair of crossed baselines some 30 and 40 km long. Signals received by the four remote receivers were retransmitted by microwave links to the fifth receiver station sited at the intersection of the two baselines, where the signals were displayed on a cluster of twelve cathode ray tubes and recorded by two rotating drum cameras. As the retransmission delays were known, times of arrival at the outstations could be calculated.

Differences between arrival times at two stations defined a hyperbolic surface containing the source. Two such surfaces that share a common axis intersect in a semi-circle, and one more difference will locate the source. The path that had been followed by the lightning was revealed by locating a succession of sources. An extra, redundant measurement was available for every fix and it was used to check that each source had been located correctly.

Signals radiated by lightning are variously called noise, atmospherics, sferics, static or QRN. They may consist of short spikes, irregularly shaped pulses, and also long rather amorphous sequences of closely spaced spikes whose envelopes usually wax and wane gradually in amplitude. I call this form Q-noise. Pulses can be timed easily. Not so Q-noise. Examples of noise, received from lightning at VHF are shown in Figure 1.

By comparing their photographs with simultaneous recordings of changes in electric field produced by lightning Schonland, Malan and others were able to catalogue waveforms of changes in electric field caused by various processes of lightning. I recorded electric field changes so that I could identify processes that had caused the radio noise that I had recorded. Examples are shown in Figures 2, 4 and 7.

When analyzing recordings of noise, the first task was to find which pulse on all five receiver channels had been caused by the same event. This was done by comparing the five traces after the various delays had been removed. Recorded times of arrival were then read from the calibrated recordings so that the positions of each source could be calculated. In 1970 the first recording that we processed lasted only 250 milliseconds, but it required an effort of six man-months to analyze and to plot 525 points along its several paths. The advent of computers, TTL electronics, and a laser optical recorder built especially for this purpose by Plessey Caswell enabled me to speed up the process considerably so that three dimensional time-resolved maps of more than 165 flashes were plotted. The Plessey recorder was capable of recording, for 20 minutes without any interruption, five channels each having bandwidths of 5 MHz. This was considered a marvelous feat in 1979.

ACCURACY

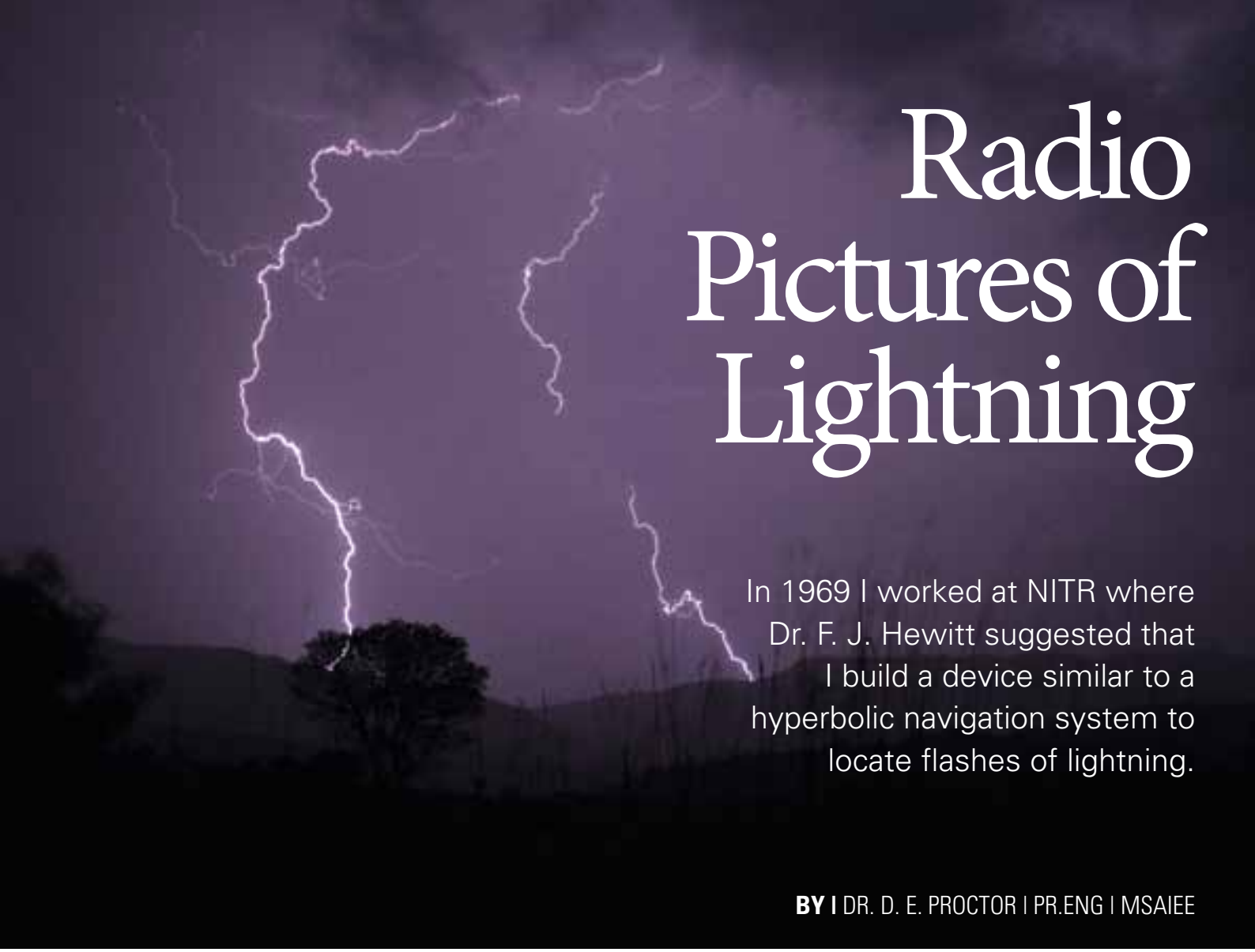
The accuracy in directions almost parallel to ground, coordinates X and Y, was approximately 25 metres. The accuracy in height, Z, varied across the coverage volume. It is large near ground away from the central station; approximately 120 metres above the central station, and is indicated in appropriate positions on the

maps. Discussed in Appendix 1.

RESULTS

Radio noise is emitted by lightning only when it ionizes the air. Initially, this ionization process occurs as a stepped leader. First photographed by Malan, the stepped leader appears as a succession of relatively bright steps 10 to 300 metres long that last about 1 microsecond, occur at intervals of several tens of microseconds and leave a faintly visible trail behind them as they forge the path of the flash.

See Schonland *et al* [1935]. They emit RF pulses (of duration a few microseconds or less) at HF and higher frequencies. These pulses consist of a succession of very short spikes that



Radio Pictures of Lightning

In 1969 I worked at NITR where Dr. F. J. Hewitt suggested that I build a device similar to a hyperbolic navigation system to locate flashes of lightning.

BY I DR. D. E. PROCTOR I PR.ENG I MSAIEE

become smeared into one envelope by the restricted bandwidth of the receiver. This was evident when sources receded from a receiver, and then the overall duration of the pulse was lengthened. Sources that approached a receiver produced pulses that appeared to have been compressed.

This was a temporal manifestation of the Doppler effect and could be used to map the extents and directions of sources directly. When plotted together so that their starting points coincided, these "pulse-width vectors" appeared to lie on the surface of a cone, which suggested that a magnetic effect had been involved in their generation. (It would be interesting to know if the light they emit is polarized as this would be evidence of super luminal electrons. Dwyer *et al* [2005] report that stepped leaders emit X-rays, indicative of high speed electrons). Plots of successive sources resembled detailed photographs of stepped leaders taken by earlier investigators.

First streamers of cloud-flashes extend by stepping just as ground-flashes do. Many flashes to ground generate more than one stepped leader. Each follows a separate path, some of which strike ground. Stepped leaders and cloud flash first streamers extend at speeds that range 3×10^4 m/s to 4.2×10^5 m/s (median 1.6×10^5 m/s).

When a downward leader approaches ground it precipitates a brilliant, rapidly moving upward streamer which is called the return stroke. It lasts approximately 90 microseconds, and serves to ground the charge that had been distributed along the path by the leader. Radio pictures showed that return strokes, on reaching to top of their paths, extend the upper portions of a ground flash beyond the starting point of the flash and they do so at speeds near 10^8 m/s. These processes emit Q-noise.

The radio studies also showed that some interstroke processes also serve to extend these paths into the cloud. They also emit Q noise. These in-cloud extensions are often horizontal, and extend in directions opposite to, or widely different from the direction in which the stepped leader had extended. One example is shown by flash 139 which produced over ten return strokes. Other interstroke processes accompany in-cloud streamers that do not reach ground. A return stroke that follows the original's path is preceded by a *dart* leader that travels

Radio Pictures of Lightning

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down the path as a luminous wavefront at a speed roughly ten times that of a stepped leader. Dart leaders emit VHF only where they extend the original path. Evidently, pulse sources can occur a hundred metres or more from what would have been the luminous channels.

Figures 3, 5, 8 and 9 show that most activity occurred above cloud-base. The first flash that I analyzed confirmed Schonland's model in which successive strokes of the same flash were supplied by charge that had resided in successively higher regions of the thundercloud. All flashes I subsequently analyzed showed that later strokes tapped charge displaced laterally from the origin, although there were branches that extended vertically. Flash origins were never influenced by the height of the 0°C isotherm. Flash 150 was about the smallest flash I analyzed. Flash 139 the greatest.

Cloud-flashes behave quite similarly to ground flashes. Because they terminate in places of lower conductivity, their recoil streamers (the counterparts of return strokes) are much less dramatic. I found that electric field changes recorded by leaders could be reproduced faithfully by a process of calculation if one assumed that the initial charge resided in a region just above (or adjacent to) the starting-point of the flash and that the flash acted to remove charge from here and to deposit it on the radio sources as they formed. One of many examples is shown in Figure 6. The waveform of electric field change is strongly dependent on the path taken by the flash.

I located the origins (starting points) of 773 flashes that occurred in 13 thunderstorms. Each origin was assumed to have been the centroid of sources of the first ten pulses to be emitted by the flash. 658 origins were mapped onto radar precipitation patterns of its host thunderstorm. The distribution of 773 heights served to confirm an earlier US report that their distribution was bimodal. Each part of the distribution was approximately Gaussian in shape.

There were 431 flash origins in the lower group and they centered about a modal height of 5.3 km amsl. 342 in the upper group had a modal height of 9.2 km amsl. Flashes in the lower group were more numerous in ten storms. 66% of the 658 that were mapped onto the radar precipitation patterns were located within 270 metres (one picture element of radar) of the 20 dBZ contour; 27 % began inside these contours and most began at edges of high-reflectivity cores. Their distribution showed a marked peak near zero distance between the origins and the nearest 20 dBZ contour. ($Z = 100$ mm^6 m^{-3} indicates a liquid water content of 0.045 gm/m^3.)

Most flashes began where precipitation gradients were high. (i.e. the distances between wet and dry regions were short). Many of the flashes whose paths had been mapped showed a tendency to track the edges of precipitation as indicated by the 20 dBZ contours. One example is shown by Figure 5. Origins tended to cluster together rather than being scattered throughout the storm. See Figure 10. All flashes that began in the lower regions produced leaders that pulsed at rates above 105 per second with short steps. All flashes with high origins produced longer pulses from longer steps which occurred at much slower rates that were near one per millisecond. All 214 flashes to ground began in the lower group. Electric field changes I recorded from 165 flashes whose paths were known functions of time enabled me to deduce their polarities. Only one of these had been a flash whose leader carried excess positive charge. A later study of high flashes revealed one whose polarity changed mid-path. Many of the higher flashes extended either horizontally or vertically into regions above the precipitation.

CONCLUDING REMARKS

Recent advances in electronics have greatly facilitated the construction of systems of this kind. A group at New Mexico Tech in Socorro, manufacturers a modern version, called the *Lightning Mapping Array,* described by Thomas *et al*. [2004]. This selects the strongest pulse in each interval of either 10 or 80 microseconds. It uses GPS to time-stamp it at thirteen stations before transmitting a digitized version via a dedicated wireless channel to the Home station, or else it is stored on local discs for later analysis. A fix is deemed acceptable if confirmed by the redundant measurements. To demonstrate its performance, it was used to track the path of an airplane whose flight-path became evident by virtue of the sparks that discharged from its wings. Impressive results. Elegant data handling. Much better accuracy.

Despite the use of improved modern techniques, most of what we know about lightning today was discovered by Schonland, Malan and their associates in South Africa. They published in a series called *Progressive Lightning* in Proceedings of the Royal Society. They worked mostly at the Bernard Price Institute at Wits. I had no opportunity to meet Sir Basil, but enjoyed reading Austin's [2001] biography.

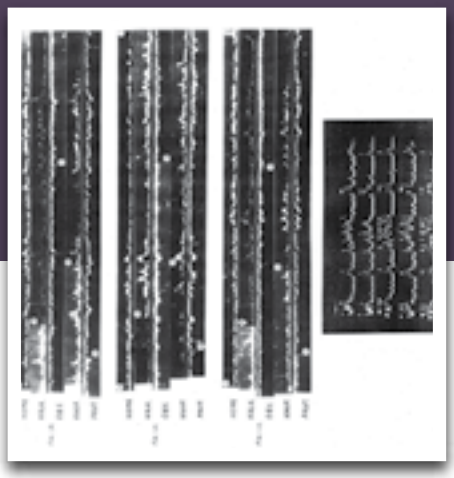

Figure 1. Examples of atmospheric waveforms received at five widely spaced stations. Delays have been removed. The amplitude response is logarithmic. Trace gaps occur at 5 microsecond intervals. Lower section shows a 25 microsecond segment of 3-bit digitized waveforms. Adapted from Proctor[1971] and Proctor et al [1988].

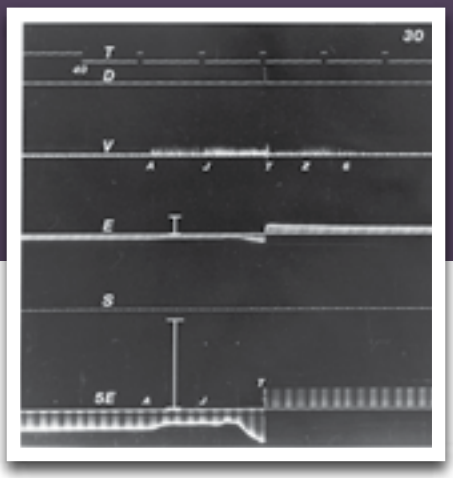

Figure 2. Event record for Flash 30. Trace T pulses at 100 millisecond intervals. Symbols A to Z and 1 to 6 on the VHF Trace relate to a time code used in Fig 3. Vertical bars on traces E and 5E indicate deflections for 5kV/m. Trace D carried dE/dt. The step change in field is caused by the return stroke. Adapted from Proctor et al [1988].

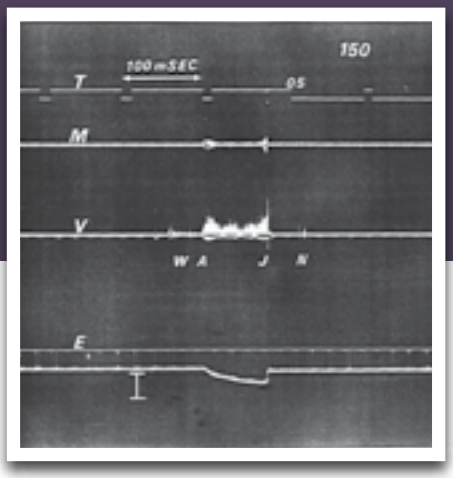

Figure 4. Slow time-base record for flash 150. Sferics at 1 MHz recorded at low gain on Trace M. Its return-stroke pulse crossed trace T. Adapted from Proctor et al [1988].

Prof. David Malan was a kind, gentle and gifted person. Two of his important papers were published in the French language and have since been largely ignored. For reviews see Malan [1963], Schonland [1956], or Uman [1987]. For a modern text on lightning see Rakov and Uman [2003].

ACKNOWLEDGEMENTS

I am grateful to CSIR for funding much of this research and also to Water Research Commission for financial assistance in later years. I am indebted to Dr. George Green, and Dr. Frank Hewitt for their good offices. I owe a special debt of gratitude to my assistants Dick Uytenbogaardt, Mrs. Bernice Meredith and Mrs. Anna-Marie Kelly for their skills and hard work. My thanks to the team at Plessey Caswell. The S.A. Weather Bureau kindly supplied the aerological data.

APPENDIX 1 - CALCULATION OF ACCURACY

A change Δx in the position of a source along a baseline gives rise to a change 2 Δx in length difference. If time can be measured to an interval Δt, then the position of the source is known to δ = c Δt/2, which is called the *baseline unit* and is the distance between the apices of two adjacent hyperbolas that can just be resolved. At some distance from the baseline, the spacing between the hyperbolas will have increased to *k* times the baseline unit. *k* is called the lane expansion and is a major cause of error in the determination of height. The relatively large error arises because of the lack

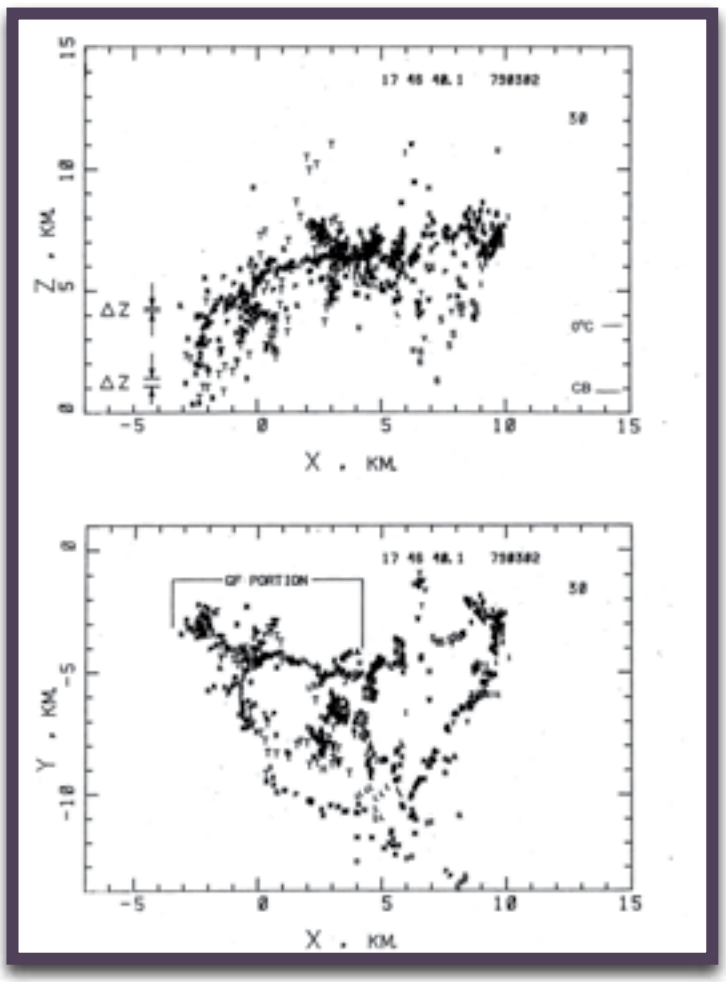

Figure 3. Plan (X,Y) and elevation views of Flash 30. Heights of cloud base (CB) and 0°C levels are indicated. Z = 0 is ground level, 1.43 km amsl. This hybrid flash covered an area 13 km by 13 km. It began as a cloud flash and branched to ground after 90 milliseconds (time J) to strike ground. Return stroke at time T extended the flash upwards beyond its origin. Adapted from Proctor et al [1988].

Radio Pictures of Lightning

continues from pg 43

of a vertical baseline. For a post-detector bandwidth B = 5 MHz the rise-time of a pulse will be $\tau = 350/B$ nanosec. and $\delta = 21$ metres. The *lane expansion* in lateral directions approximates 1.1 so that accuracy is approximately 25 metres. The height accuracy varies across the coverage volume. It is large near ground away from the central station; approximately 120 metres above the central station, and is indicated in appropriate positions on the maps. wn

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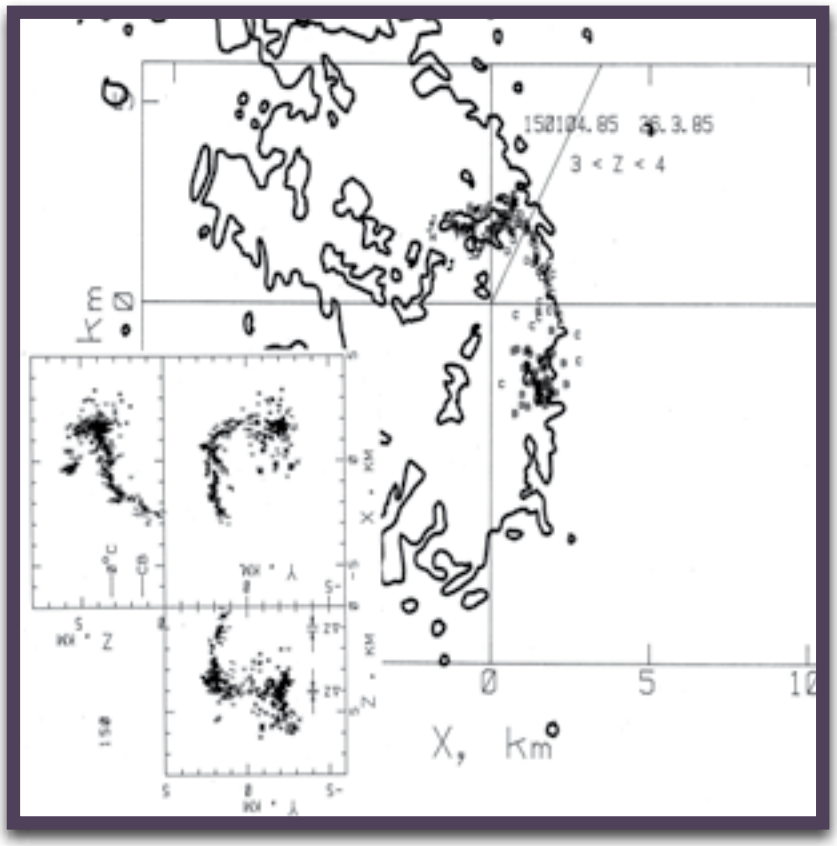


Figure 5. Sources of Flash 150 at heights 3 to 4 km AGL compared with the radar CAPPI (Constant Altitude Plan Position Indicator) for 3.5 km showing the contour for 20 dBZ. Notice how the flash tracked this contour and descended at a hole in the precipitation. The inset shows three views of the flash. Symbols changed every ten milliseconds. Adapted from Proctor et al [1988].

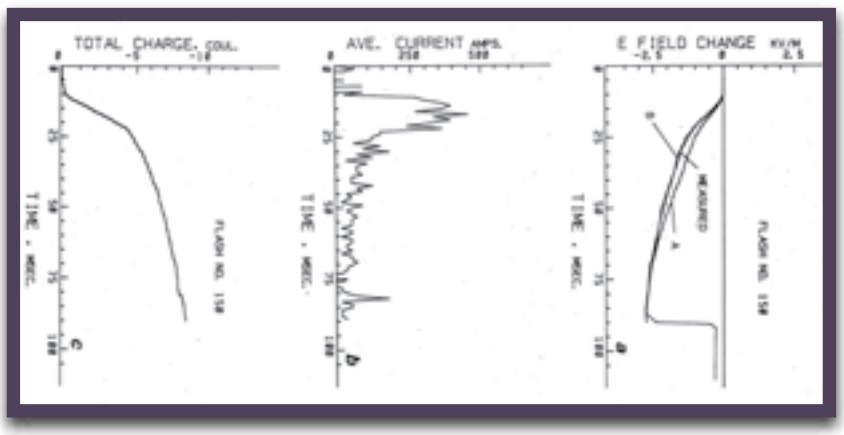


Figure 6. Part a shows the electric field change recorded by Flash 150 and calculated waveforms for two models. Part b shows the averaged current that flowed from the origin (calculated from model B) and part c shows the charge supplied to the leader stroke. Adapted from Proctor et al [1988].

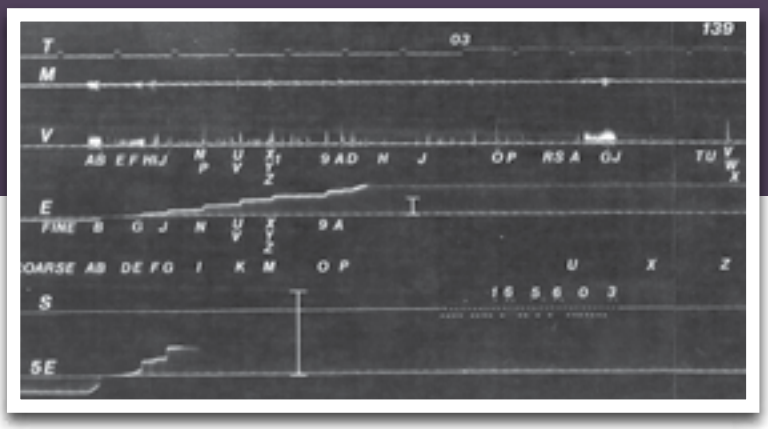


Figure 7. Auxiliary record for flash 139. Trace S carried the serial time code common to all the instruments on site. Stepped leaders occurred at times A, EF, and later B to J. It produced at least ten return strokes. Its field changes saturated both displays. Adapted from Proctor et al [1988].

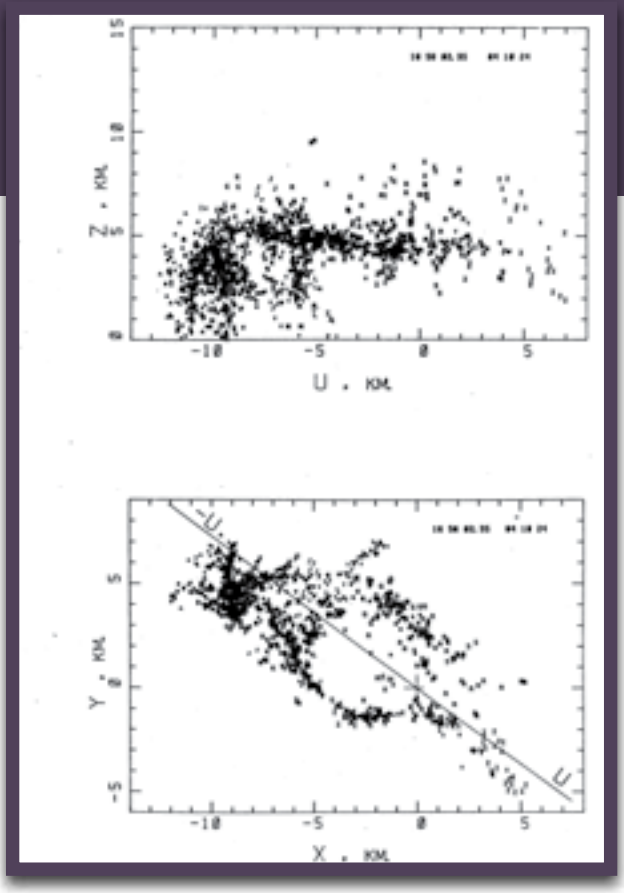


Figure 8. Plan and elevation views of Flash 139. Many more plots were necessary to show the detail of this flash. Symbols here use the coarse scale shown in the previous figure. Adapted from Proctor et al [1988].

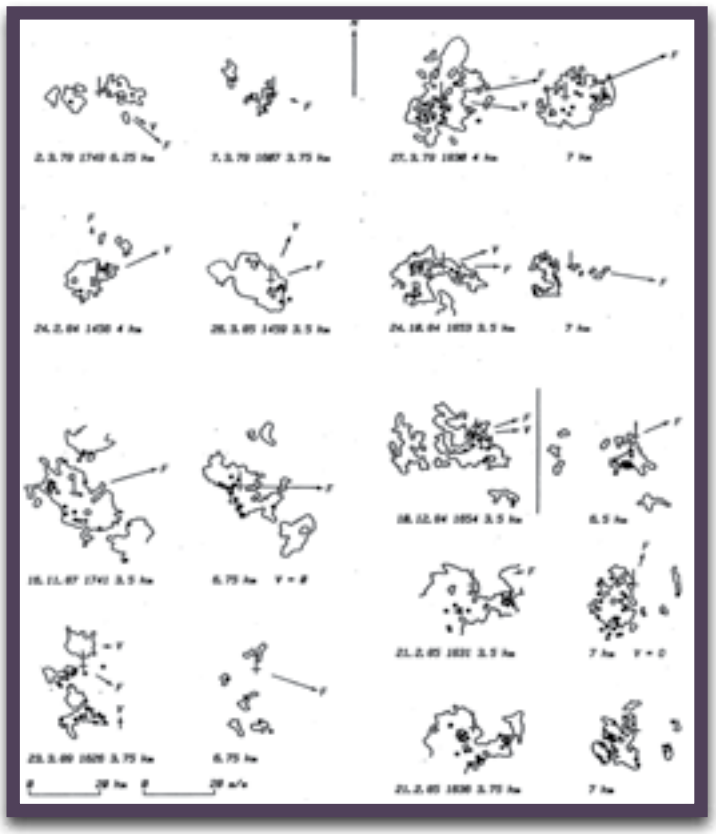


Figure 10. Tracing of 20 dBZ contours of CAPPI's at the stated dates, times and heights AGL. Origins of lightning flashes have been mapped with round dots. Vectors V indicate directions of storm motion. F indicates directions of environmental airflows at the stated heights and are opposite to wind directions. N indicates true North. The storm of March 7 did not translate during the observation period but spread in all directions. Notice how the flash origins cluster together and how they occurred near the contours. Adapted from Proctor [1991].

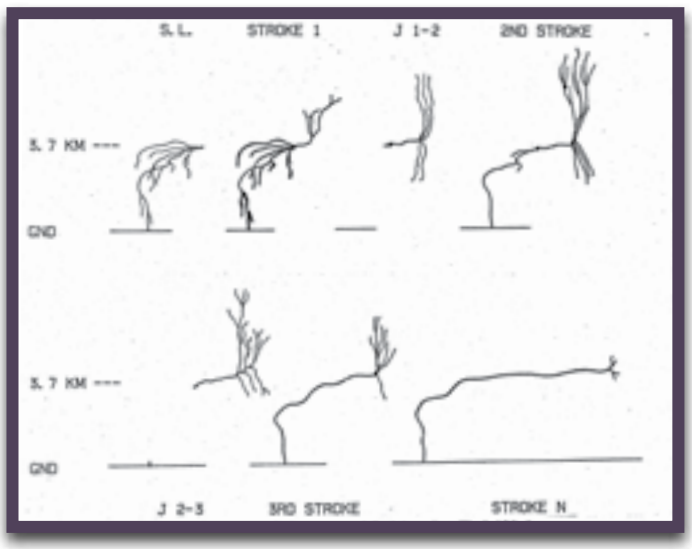
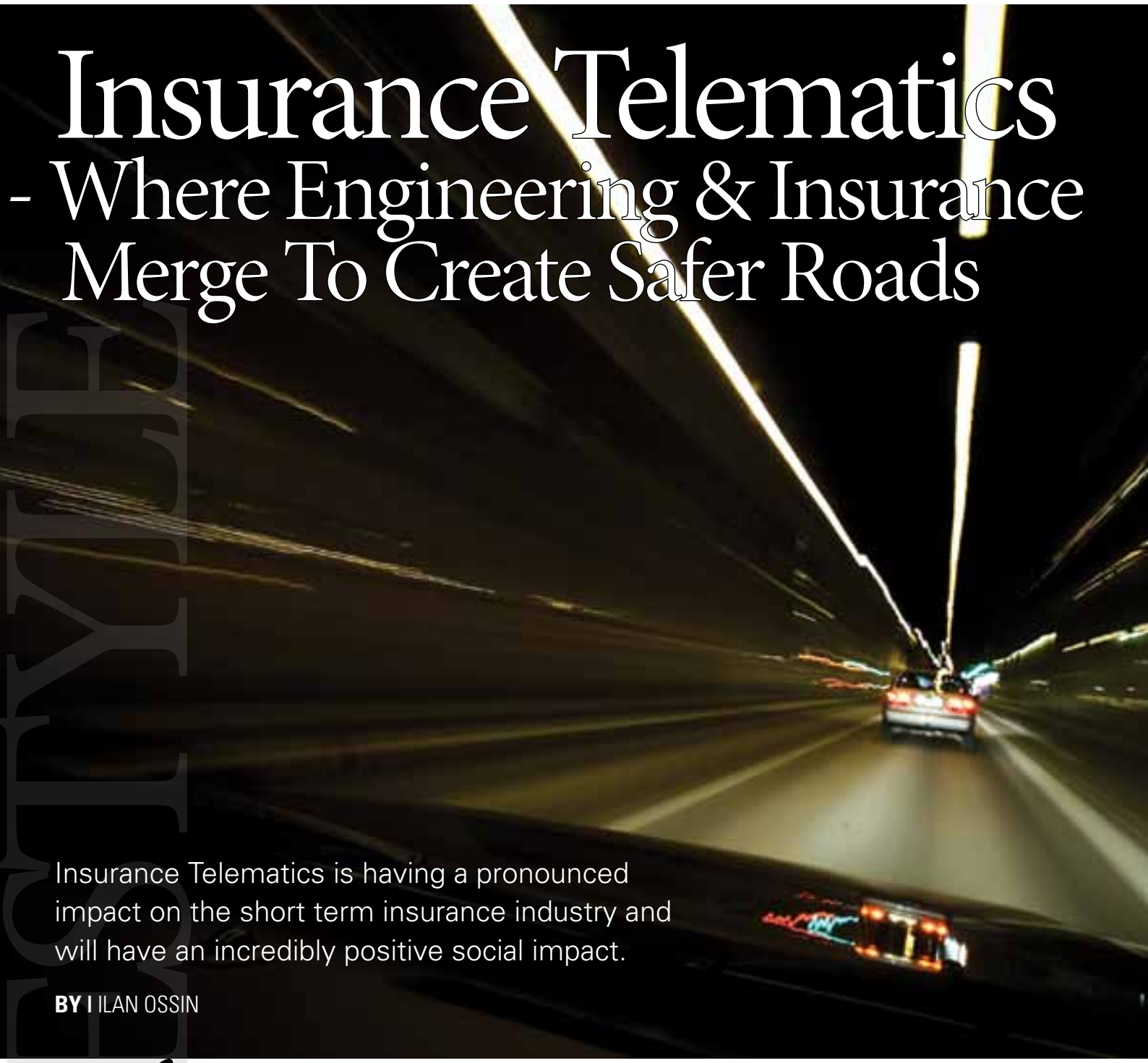


Figure 9. Model of a large ground flash based on Flash 139. J indicates interstroke processes. GND level is 1.4 km amsl. Adapted from Proctor et al [1988].

LEGEND OF DETAILED PICTURE

Detailed plan views of the short, almost horizontal segment of the main channel of a high cloud-flash. Top right inset shows a drawing of the whole flash. Radii of circles map the rms errors of measurement. Arrows in b map Pulse Width Vectors projected onto a horizontal plane. Section c shows the sequence in time. Plan views shown in a,d,e, and f. Adapted from Proctor [1981].

Insurance Telematics - Where Engineering & Insurance Merge To Create Safer Roads



Insurance Telematics is having a pronounced impact on the short term insurance industry and will have an incredibly positive social impact.

BY | ILAN OSSIN

The short term insurance industry which insures both vehicles and household content traditionally uses standard rating factors in determining the risk of insuring a particular vehicle or home. Particularly on the vehicle side of the business, rating factors such as Gender, Age, Vehicle type, etc are currently used to create the actuarial model which results in the premiums we pay today. Insurance Telematics is the use of monitoring systems fitted in a vehicle that makes use of various built in sensors such as GPS, Accelerometers, Various tap in points from the vehicle to measure how well a person is driving. Most devices typically monitor the forces being applied to the vehicle. These forces can determine if the driver is braking or accelerating excessively. Lateral forces can also be measured to determine how drivers manoeuvre around corners. Typically if any of these manoeuvres result in high G forces then it means that the driver is more likely to be involved in an accident. These new measurements or rating factors are now possible to measure within the insurance industry thanks to telematics technology. These new factors

are deemed fairer in determining risk as opposed to the current more static factors.

The use of this technology in the insurance application creates a business plan where the outcome of the plan is for the betterment of both the insurance business and society at large. The key use of the technology is ultimately to reduce a clients driving risk and make them better drivers. Better drivers will impact the loss ratio (claims to premium ratio) for the insurance company while at the same time creating safer roads. This is an incredible complementary business model resulting in positive outcomes for both the private sector and society at large – given the unacceptably high levels of road accidents in South Africa.

With the technology currently on the market, we are literally only scraping the surface of the possibilities that exist in terms of what we can measure and how we can measure it. Some insurance companies retrofit devices to vehicle using skilled technicians – others use "plug and play" devices that fit into the vehicles OBD (On board diagnostics) port

Debate on the type of device to use is ongoing within the industry with no real "right" or "wrong" answer at this point – each having their own pros and cons. Lately the use of Smartphones has also come into the equation – this too has entered the industries great technical debate. Smartphones are seemingly becoming a viable option for measuring the driver behaviour as its inherent advanced hardware coupled with intelligent applications becomes an attractive option in terms of cost, however the fact that the device is controlled by the driver of the vehicle becomes the key challenge to overcome when deploying this option.

Mobile SIM cards are starting to become a standard feature inside the vehicle itself at the OEM (Original Equipment Manufacturer) level. A key example of this is the deployment of the Vodafone Global M2M ChipSIM into the new range of BMW series vehicles1. This global SIM will allow for communication from the vehicle to BMW servers anywhere in the world without the need for local BMW offices having to create unique deals with their local mobile operators to open up the lines of communication.

This type of trend within the automotive industry strongly supports the insurance telematics industry as data will eventually be sent to the insurance company direct from the vehicle, without a need for third party devices. Traditional telemetry solution providers that have offered full end to end delivery of the technology (device through to data presentation) may find a shift in their business acting as an intermediary in providing the data as opposed to also supplying and fitting devices.

Insurance Telematics is an emerging and exciting new leap for the industry with a common underlying goal of reducing risk and thus creating safer roads. Technical developments in this space are changing rapidly allowing for easier transfer of data and creating other key metrics that may become measurable for changing driver behaviour and reducing risk. Watch this space as technology reinvents the way you are insured today! wn

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Minimisation of data sets

CONSIDER FIRST A FAMILIAR SYSTEM OF WEIGHTS:

BY | W A (BILL) BRADING **|** CENG UK **|** FSAIEE **|** FIET

A DECIMAL SET

Usually the set comprises weights of 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, 200, 500 and continuations of this sequence with duplication of the 2, 20, etc. To be able to weigh up to 1110 in unit steps requires 12 weights.

A measure of 12/1110 = 0.010811

A BINARY SET

This would have the sequence 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, etc. To weigh up to 1023 in unit steps requires 10 weights.

A measure of 10/1023 = 0.009775

A TERNARY SET

This would use the sequence 1, 3, 9, 27, 81, 243, 729, etc. To weigh up to 1093 in unit steps requires 7 weights.

A measure of 7/1093 = 0.006404

In spite of the greater number of weights the decimal set has the advantage of ease of calculation, hence its preference in the metric system. The binary system has its origins in the imperial weights and measures, typically pounds and ounces. Its primary value lies in its ease of division. It becomes cumbersome as the numbers get larger, for example to use 500 requires 256 +128 +64 +32 +16 + 4. In binary notation this number would be written 111110100.

The ternary system in spite of its efficiency in numbers is even worse since it needs its component weights to be used in the negative sense, i.e., for some of its weights to be placed in the scale pan with the object to be weighed. In this case 500 would require 729 - 243 +27 -9 -3 -1. In other words 243 +9 +3 +1 would be placed in the pan with the object to be weighed with 729 +27 in the other.
In bipolar ternary notation this number would be written +– 0 +– – – *(see note)*.

Now consider the transmission of a number using a sequence of symbols each having a number of states. As an example the numbers up to 1000 can be expressed as a set of three digits each having a choice of ten states, 000 – 999. We can assign a value *m* to the product of symbols times states as a measure of this so that for the decimal case m = 30. This same set of numbers can be transmitted in 10 binary symbols each having two states so for binary *m* = 20. On this basis binary is seen to be more efficient. It is of interest to explore this further to see if there is a minimum.

A number N expressed with a radix r requires y digits where $y = \log_r N$

Since $y = \log_r N$ *then* $N = r^y \quad \therefore \quad \ln N = y \ln r$ *and* $y = \frac{\ln N}{\ln r}$

A measure applied to this would be $m = ry$. r being the number of states of y digits. To find a minimum value for m we differentiate m with reference to r.

$$m = ry = r \log_r N = r \frac{\ln N}{\ln r}$$

$$\frac{dm}{dr} = \frac{\ln N \left(\ln r - \frac{r}{r} \right)}{(\ln r)^2} = 0 \quad \therefore \quad \ln r = 1 \quad and \quad r = e \quad \ln r \neq 0$$

This implies that a system of numbering based on a radix of *e* (the base of natural logarithms) is most efficient but clearly impractical. A base 3 system would come close. Numbers to 1000 in base 3 would require 6.3 digits giving a measure of 18.86, very close to the minimum of 18.78.

If we use *E* as an indication of efficiency and take the optimum as 100% then $E = 100 \frac{m(e)}{m(r)} = 100 \frac{e \ln r}{r}$

TABULATING

r	2	3	4	5	6	8	10	16
E%	94.21	99.54	94.21	87.50	81.18	70.66	62.59	47.10

NOTE

The decimal number 500 in normal ternary notation is 200112. As an exercise try to find an algorithm to convert this to the alternative bipolar ternary +– 0 +– – – .

ANSWER

Select the rightmost (least significant) digit.
If *0* write *0*. If *1* write +. If *2* write – and add *1* to next digit on the left.

If this causes that digit to exceed 2 change it to *0* and add *1* to the next digit. This is the same as the normal carry operation in decimal arithmetic and may propagate through some of the remaining digits each time it occurs. Continue working through all the digits. wn

Powertech Transformers (PTT), a subsidiary of Powertech and the JSE listed Altron Group entered into a supply agreement with TMC Italia S.p.A in late 2011 for cast-resin dry type windings/coils and transformers.

The agreement covers windings/coils and transformers up to 3 150kVA with the range increasing to 20MVA.

TMC is one of the leading manufacturers of cast resin dry type transformers acting on a global scale and are headquartered in the Milan area in Italy.

TMC's design and manufacturing operation includes manufacturing sites in Italy and Spain, assembly facilities in Argentina and Israel as well as commercial premises in Germany, UK and Brazil.

Industrial partnerships have been developed with top reliable partners in South Africa, Thailand and South America.

The cast-resin dry type transformers will be assembled and tested in Powertech Transformers' distribution transformer factory in Booysens, Johannesburg and will complement the range of transformers already being manufactured in this factory.

Leon Viljoen, CEO Powertech Transformers says, "We decided in 2010 that Powertech Transformers need to be in the dry type transformer market. We searched internationally for a partner that has a very similar vision than PTT together with technical expertise as well as an internationally established manufacturing footprint. We found TMC fitted the profile and we signed the supply agreement earlier in 2011. Together we believe we have the market knowledge, technical capability and manufacturing expertise to serve the SSA market."

Cast-resin dry type transformers are normally installed in the following environments namely, high-rise buildings; airports; military installations; off-shore platforms; shopping malls; banks; hospitals; schools; mines; motor vehicle manufacturing plants; textile manufacturing plants; paper mills and all other environments where fire hazards are a risk.

The advantages of these types of transformers are namely the following:-
They are highly resistant to fire and are self-extinguishing; the installation environment does not require particular characteristics (contrary to oil transformers which require fire or catchment barriers); they are used in highly humid and polluted environments; there is no maintenance required (contrary to oil transformers); they are highly resistant to short circuit stresses as well as over voltages; they show less stress on insulation and have smaller dimensions than dry-type non-cast resin transformers; their windings are compact and the transformers are easily handled and have high mechanical strength.

Power and distribution transformers for Sub Saharan Africa are manufactured by Powertech Transformers at its operations in Pretoria West, Cape Town and Johannesburg.

Powertech Transformers is 80% owned by Power Technologies (Pty) Ltd (Powertech), the largest power-electrical group in Southern Africa and 20% owned by Power Matla. Its main business is the design, manufacturing and selling of a complete range of power and distribution transformers for the African continent. Powertech Transformers' factories in Pretoria West, Johannesburg and Cape Town are state of the art world class facilities, amongst the best in the Southern hemisphere boasting ISO9001, ISO14001 and ISO18001 quality, environmental and health and safety listings respectively.

For more information please visit www.pttransformers.co.za.

Powertech
Transformers

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Notes on Modern Electrical Machinery – 1912

During a recent trip to Europe, the writer visited several electrical factories and works, and in response to an invitation from the Council of the Institute presented the following notes, dealing briefly with some of the 'modern' machinery inspected.

WRITTEN BY | F.H. MITCHELL (MEMBER - 1912)
COMPILED BY | ALAN MEYER | FSAIEE

EXCERPT FROM THE TRANSACTIONS VOLIII - 1912

The following important factories and works were visited: Siemens' Dynamo Works, Stafford; Siemens' Cable Works, Woolwich1; AEG Turbo Generator Works, Berlin; Siemens' Dynamo Works, Berlin.

During a cycle tour some interesting small hydroelectric plants were discovered, one of which, at Porlock in Somerset, consist of simply a bucket waterwheel driving a dynamo.

Perhaps the most striking feature of up-to-date electrical manufacture is the high state of standardization and specialization reached in a branch of engineering so comparatively young. In passing through a large factory, one is astonished at the rapidity with which the various parts of electrical machinery are built up by different departments, the workers in which have generally no idea concerning the principles or utility associated with the finished article. In many departments, including armature winding, women and girls employed carrying out the work, in most cases more satisfactorily than, men, for approximately half the wages.

The process of construction of modern electrical machinery is intensely interesting. Sheets of Scandinavian iron are delivered by rail to the factory. They are first coated with an adhesive upon which thin paper is laid. The sheets are next passed over a heating apparatus consisting of a number of small burners – the paper on the upper side of course. The velocity is adjusted so as to render the adhesive suitably dry, the edgings of paper being at the same time burnt off, without injury to the rest. The sheets may be passed on at once or to the stamping department, the machines in which are operated by youths or women.

The writer was deeply interested in a large turbo-generator factory in Berlin, in which one of the two largest generators so far designed (20,000 k.v.a.) was under construction. The alternators built in this factory are of the revolving field type, and it is held by the makers that the rotors are designed and built so as to fulfil the following requirements:

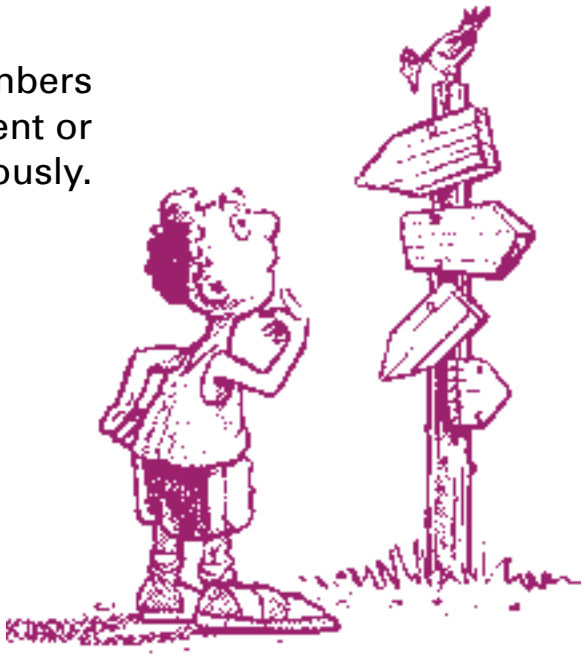
1. Capability of withstanding enormous centrifugal force.
2. Good balance guaranteed by solidity of design.
3. Critical velocity avoided.
4. Satisfactory dissipation of large quantities of heat.

The writer visited Siemens' large new cable factory, which is a triumph in the development of modern methods. The process of constructing cables is fully understood and appreciated by the visitor from the drawing of the wires to the final winding on the drum. The drums of cable are loaded on to canal boats, which convey them to Stettin or Hamburg.

The writer visited the Greenwich Power Station, and was impressed with the admirable lay out of the plant. One can inspect the station in one's Sunday clothes, and not be afraid of going to church, in England, afterwards. The large alternators designed by Prof. Buchanan, were running splendidly. wn

This page is dedicated to members who would like to comment or opinionate anonymously.

Say wat?



The international trend as I understand it is to create a trading house for energy suppliers to contribute to the grid. For this to happen the control of all energy must reside in transmission system – correct?

In South Africa generation, transmission and some distribution all reside in one entity Eskom and therefore to follow international trends transmission needs to be separated from the other two functions and in fact all three should be separated because the distribution system is already in two camps – Eskom and Local Government.

I read in the press recently a case has been made to not unbundle Eskom and have transmission controlled by an independent entity because this could affect Eskom's credit rating.

So the first bit of confusion is raised in my mind – Why an independent entity and why is a credit rating being used to prevent the adoption of best practice?

For renewable energy resources to contribute effectively to SA energy needs I would think that a centralized energy trading house is essential. The correct term I am told is "Independent System and Market Operator"

So I am confused about why a debate about whether an independent or a ring-fenced function of Eskom is taking place at all. Apart from whether a credit rating is affected surely with appropriate transparency and the magic of modern technology it does not matter which way transmission is managed. What is important is that an equitable arrangement is agreed to allow all the available sources of energy to contribution to the grid. So my question is why the debate? Is it due to self interest or future vested interests to the detriment of doing the right thing – first time?

Furthermore I understand that Parliament did not get a due diligence report it had requested because Eskom did not get permission from it's shareholder the Department of Public Enterprises in time.

A shareholder implies that there are more than just one and I would like to know who else is a shareholder of Eskom? Next time round another shareholder may not agree to the due diligence report and thus another delay. Really what confuses me more than just my ignorance about who has shares in Eskom is the fact that the various Government Departments seem to be misaligned or in competition on the restructure or not of South Africa's energy strategy and policy. Is it me or is there reason to be confused?

Lastly I understand that a new initiative by the Portfolio Committee on Energy invited submissions in July this year on the restructuring of the Electricity Distribution Industry (EDI). What happened to the 10 or 12 years of restructuring exercises that were done and is any of that huge effort of any use by the invitee?

Can someone who knows about these things please help me with my confusion and about how the electricity supply industry is being directed and who is making the decisions.

FREA KINOUT

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You said...

Dear Editor,

This letter relates to the CFL article published in the January issue of **watt**now:

MERCURY CONTENT IN COMPACT FLUORESCENT LAMPS (CFLS)

Compact Fluorescent Lamps (CFLs) play a key role in Eskom's energy efficiency campaign. CFLs are an internationally agreed, simple, but effective measure against ever-increasing, energy constraints and rising energy costs.

Frequently e-mails are circulated around "health scares" related to CFLs due to the mercury content of CFLs. What is interesting is that these "health scares" have never been associated with traditional fluorescent tubes that have higher mercury content and are far more prevalent than the compact version.

The e-mails are not linked to Eskom, but nevertheless, Eskom as a responsible corporate citizen, has increased its general awareness of CFLs, its benefits, its safe handling and its correct disposal, on our website, in the print media and via brochures and fact sheets. As we are a distributer of CFLs we have taken it upon ourselves to educate widely on the correct disposal of the bulbs. A general duty for waste management is imposed by the National environmental Waste Act 59 of 2008 on "(2) Any person who sells a product that may be used by the public and that is likely to result in the generation of hazardous waste must take reasonable steps to inform the public of the impact of that waste on health and the environment".

DEALING WITH AN ALLEGED MERCURY INCIDENT

Eskom approached the local lighting industry and the South African Energy Research Institute (SANERI) regarding an injury claim, to review the injury and to advise on its legitimacy. We also sought medical opinion from an international medical authority on the hazards of mercury, the likelihood of CFL shards causing drastic tissue injury and any additional medical procedures with regards to cuts sustained from CFL shards.

Eskom doctors were also approached for their comment. A large lamp manufacturer offered evidence of several incidents at their manufacturing facilities with no similar reactions or injuries by any of the injured.

Our findings from the experts mentioned stated that it was highly unlikely that the incident and the alleged damage was caused by a mercury containing lamp, and that other factors had to have caused the alleged damage.

Not only is CFL technology strongly supported by the Department of Energy (DoE) to promote energy efficiency but is seen worldwide as a suitable replacement for incandescent lamps.

All CFLs purchased by Eskom comply with the Efficient Lighting Initiative (Ell), Restriction of Hazardous Substances Act (RoHS) and SABS standards - all of which restricts the mercury content to 5mg in compliance with international best practice. Eskom has endeavoured to educate, as far as possible, on mercury content, safe handling and disposal of CFL's via fact sheets, pamphlets, disposal and recycling guidelines, educational advertorials in consumer magazines and online mediums. With every CFL rollout Eskom has supplied step-by-step guides to recipients of free CFLs on how to dispose of used/spent CFLs in the most environmentally friendly manner, as well as on what to do if a CFL breaks.

We have indicated to the DEA that we urgently need the finalization of this process so that we can operate under the guideline of this plan, but until then we await its outcome like the rest of the South Africa. The responsible handling, use and disposal of spent CFLs has been and remains a priority for Eskom.

Kind regards

Andrew Etzinger
SENIOR GENERAL MANAGER (INTEGRATED DEMAND MANAGEMENT)

ED - Thank you for setting the record straight, Mr Etzinger. We are grateful to Eskom for their initiative of aiding the public in the correct disposal of CFLs. wn

Send your letters, compliments, complaints, opinions to minx@saiee.org.za

WIN YOU VERY OWN COPY NOW!

"I like T-Bone steaks, because they are in the shape of Africa.'

Desmond Tutu,
Patron of National Braai Day

South Africa celebrates National Braai Day on 24 September every year.

The driving force behind this initiative is a man known as Jan Braai. If anyone knows how to braai, it is Jan. He has braaied with thousands of South Africans and has braaied everywhere in the country. Jan knows what people want to know about braaing.

In Fireworks, his first book, Jan shares his knowledge about braaing: about making fires with wood and about cooking great meals on the coals. Start with Jan's clear rules for braaing the perfect steak and, once you have mastered that, move on to lamb chops, curried sosaties and his famous Oxtail Potjie. Once you've mastered the art of a potjie, you can try a rack of lamb, lamb on the spit, the perfect braaied ribs and the braai staples of braai broodjies, Stywe pap, Mealies on the braai and even a dessert or two.

Hunting and fishing may not be the measure of a man any longer but you do need to be able to make the perfect braai, without fuss or fanfare. It's just one of those things that separate the men from the boys.

Who is Jan Braai?

His real name is Jan Scannell and he lives to braai. He started the National Braai Day initiative in 2005 and his aim is to create a national celebration of the one activity all South Africans have in common, regardless of race, language, gender or wealth, cooking over a fire.

He holds the world record for the longest braai. His TV programme Braai vir Erfenis on Kyknet in 2011 drew record audiences. His is currently filming his second TV series for Kyknet. For more about Jan Braai visit www.braai.com

To win your very own copy of "Jan Braai", answer this easy question:
What is Jan Braai's real name?

Email your answer, with name and postal address to minx@saiee.org.za - to reach us by no later than 10 September 2012. T&C applies.
*Jan Braai is published by Pan Macmillan South Africa | **T** 011 731 3440 |**E** precious@panmacmillan.co.za | Retail Price R250 (incl.)*

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30-31	Photovoltaic Solar Systems	Attilio Dalvit	2
SEPT 11-12	Electromagnetism – Transformers	Viv Cohen	2
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19-20	Mastering Fault Calculations	Prof Piet Swart	2
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23-25	Power Systems Harmonics	Prof Piet Swart	3

DURBAN

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SAIEE




The Engineering Council of South Africa (ECSA) is a statutory body established in terms of the Engineering Profession Act (EPA), 46 of 2000. ECSA's primary role is the regulation of the engineering profession in terms of this Act. Its core functions are the accreditation of engineering programmes, registration of persons as professionals in specified categories and the regulation of the practice of registered persons.

Consequently, ECSA is the only body in South Africa authorised to register engineering professionals or bestow the use of engineering titles, such as Pr Eng, Pr Tech Eng, Pr Techni Eng, Pr Cert Eng, on persons who have met the requisite professional registration criteria.

ECSA is under the leadership of Dr Oswald Franks Pr Eng, ECSA CEO and Cyril Gamede Pr Eng, ECSA President.

For more information on ECSA, please go to www.ecsa.co.za or call 011 607 9500.

Engineering Council of South Africa

Waterview Corner Building, 2 Ernest Oppenheimer Avenue, Bruma Lake Office Park, Bruma, 2198, Johannesburg

Tel/Direct: +27 (0)11 607 9585 Fax: +27 (0)86 246 7480

SAIEE Membership Benefits

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

You simply cannot afford not to be a member!

- A discount of up to R1110 on their ECSA registration fee, which is due in April every year, provided that they join the SAIEE before the end of March that same year.
- Upon joining the SAIEE there is a standard entrance fee of R650, an annual membership fee of R840 for Members, and between R1027 and R1113 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.
- The SAIEE Africa Research Journal (ARJ) our peer reviewed research publication (which incorporates the SAIEE Transactions) is also available to SAIEE member's quarterly upon request.
- The real rewards of being a member can be realized through attending monthly lectures, debates, tours and site visits organized by the SAIEE. These are mostly free of charge and provide refreshments at no extra cost. Members are awarded valuable CPD credits for attending these events.
- Membership has significant career benefits, as membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for members to interact with normally inaccessible captains of industry.
- SAIEE letters after your name indicate your membership grade and are a useful measure of your experience.
- Members receive generous discounts on the SAIEE run CPD courses and earn (category 1) CPD credits. Members also have the option of joining the wattnow online CPD program at a fraction of the cost.
- The SAIEE mentorship program assists members to gain professional status through the Institutes large database of mentors.
- SAIEE members are awarded 1 CPD credit (Category3) for being a member of the SAIEE.
- Members are able to serve on organizing committees and gain valuable experience and professional networking in doing so.
- Use the electrical engineering library at SAIEE House.

APPLICATION REQUIREMENTS FOR SAIEE MEMBERSHIP

It is always exciting to receive an application as it means that we will soon be welcoming another new and valuable SAIEE member to our family of nearly 6000 members. However, more often than not the application is incomplete.

To avoid unnecessary delays in the process it is important to highlight the problems regularly experienced within the administration with received applications:-
Many applicants do not read the list of requirements. We require the following documents:

- Copy of the applicants ***ID***;
- Certified copies of ***achievement certificates***;
- A copy of the applicants ***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!!

2012 Membership fees

Rates as from 1st January 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.

18A Gill Street | Observatory |T 011 487 3003 |F 011 487 3002
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Mentorship

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

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

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

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

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

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

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

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

SAIEE

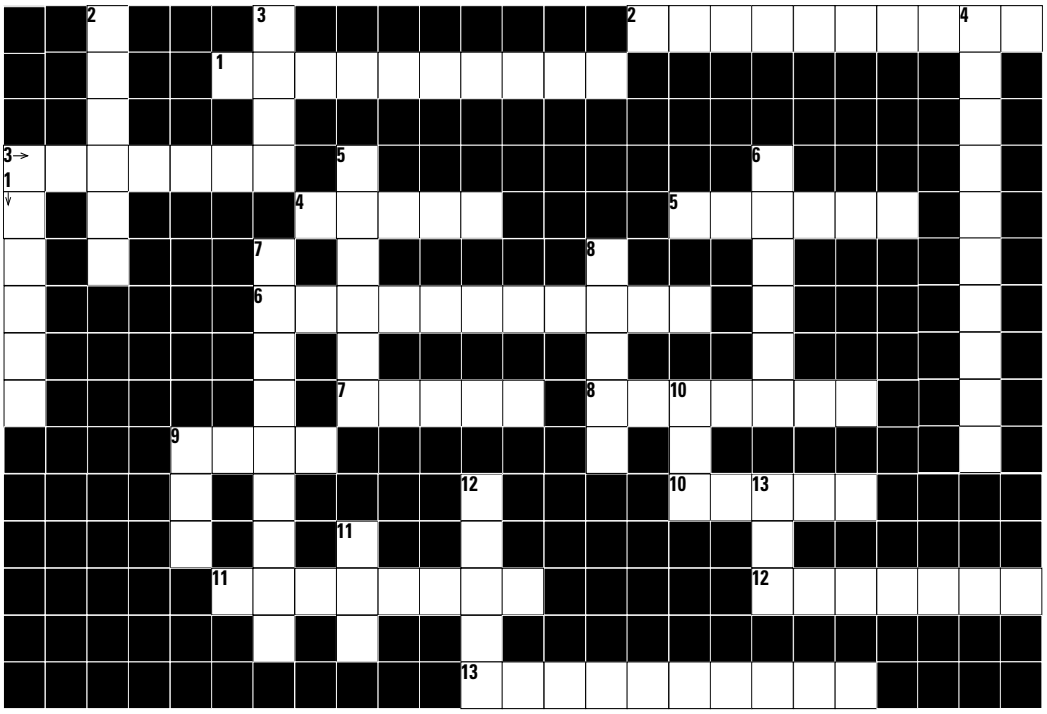
PROSPECTIVE SAIEE MENTORS

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

Have some fun and stand a chance to win R1000. Complete the August issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, August Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **30 September 2012**. The winner of R1000 will be announced in the October issue of the **watt**now magazine.

win R1000

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



ACROSS

1. Surname of the first Chairman of Escom. (10)
2. See 9 Down.
3. Who invented the first lightbulb in 1800? (7,4)
4. Which power station in South Africa will be the first power station in the world to be retrofitted with pulse jet fabric filter plants on three of its six units? (5)
5. Who built the world's first large-scale electrical suply network? (6,6)
6. The name of the road in SA which sorts the first 'green' street lights.(11)
7. Electricity Supply Commission, abbr. (5)
8. In 1791, who published his discovery of biolelectecity, demonstrating that electricity was the medium by which nerve cells passed signals to the muscles? (5,7)
9. Association of Municipal Electrcity Undertakings (abbr.) (4)
10. Average time in years it takes to build a power station (5)
11. Which American Entrepreneur inventwd the first electronic aplifying device? (3,2,6)
12. Surname of the first electrical engineer & who designed the versorium? (7)
13. Mr Volta's name, who devised the electrophorys in 1775. (10)

DOWN

1. Who is the recipient of the 2011 IEEE EAB Meritorius Achievement Award, and SAIEE member? (3,6)
2. See 5 across.
3. See 3 across.
4. Person at the SAIEE who works with Membership (5,5)
5. Which power station in South Africa will be the first to have flu gas desulphurisation technology installed? (6)
6. Who is the TRUE father of Electricity? (6,5)
7. The name of the first city in the Southern Hemphisphere to install electric street lighting? (9)
8. See 8 across.
9. One of the companies supporting the DesignChallenge Competition. (3,10)
10. See 11 across.
12. See 6 down.
13. Greenhouse Gas (abbr.) (3)

CONGRATS

June issue Winner:
Terence Dean from Pretoria

ACROSS 1 Craig **2** Solar Energy **3** Photo Electric **4** Sishen **5** Nano **6** ECSA **7** CSP **8** Bruno **9** Turanor **10** Sue **11** Russell **12** Lange

DOWN 1 Printing Press **2** Greenhouses **3** Andasol **4** Petawatt **5** ISO **6** Loomes **7** Charles **8** Becquerel **9** Edmond **10** Fritts **11** OHL **12** Nil

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. **watt**now magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the **watt**now magazine. 7. Closing date for entry is 30 September 2012. 8. The winner will be announced in the October issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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

Calendar of events

SEPTEMBER 2012

3-6	Hydro Power Africa Conference and Exhibition	International Convention Centre, Cape Town	www.hydropowerafrica.com
3-6	Solar Energy Africa World 2012	International Convention Centre, Cape Town	www.spintelligent.co.za
10-13	Cloud Computing Africa Conference & Exhibition	Sandton Convention Centre, Johannesburg	www.terrapinn.com
20-21	Energy Efficiency and Behaviour Conference 2012	Helsinki, Finland	www.behave2012.info
28	SAIEE Annual Golf Day	Royal Johannesburg & Kensington Golf Club	geyerg@saiee.org.za

OCTOBER 2012

2-3	MVNO's Industry Summit	Southern Sun Hotel, Cape Town	africa.mvnoindustrysummit.com
8-9	2nd Annual Smart Grid And Smart Meter Summit	Abu Dhabi, UAE	www.flemminggulf.com
15-17	63rd AMEU Convention	Emperor's Palace, JHB	www.ameu.co.za
16-18	Broadband World Forum 2012	Amsterdam, Netherlands	www.broadbandworldforum.com
19	SAIEE Annual Banquet	Wanderers Club, Illovo, Johannesburg	www.saiee.org.za
23-25	Africa Electricity 2012	Gallagher Convention Centre, Johannesburg	www.africaelectricity.com
28-30	Retirement Expo	Coca-Cola Dome, Johannesburg	www.retirementexpo.co.za

NOVEMBER 2012

6-8	Power-Gen Africa	Sandton Convention Centre, Johannesburg	www.powergenafrica.com
16	**watt**now Birthday Bash Networking Breakfast	t.b.c.	minx@saiee.org.za
22	SAIEE National Student Project Competition	University of Stellenbosch	www.saiee.org.za
23-25	The Green Expo	International Convention Centre, Cape Town	www.thegreenexpo.co.za
28-30	Solar & Energy Saving Products China Sourcing Fair	Gallagher Convention Centre, Johannesburg	www.tradeshow.globalsources.com

JANUARY 2013

24-25	SAIEE Renewable Energy Conference	SAIEE House, Observatory, Johannesburg	www.saiee.org.za

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7	P.P.S.	0861 777 146	www.pps.co.za
11	Spintelligent - SolarEnergyAfrica	021 700 3500	www.solarenergy-africa.com
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