# wattnow

SAIEE SUPPORTS ENERGY EFFICIENCY AND THE ENVIRONMENT

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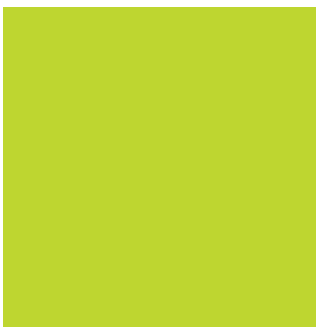
## the Solar issue

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

*“Our strength, your advantage”*

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wattnow magazine

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It is June and in this issue of the wattnow magazine, we feature a very 'hot' subject, namely - Solar. I was fascinated with the very first Solar Power Boat, which toured around the world only powered by the sun. Read more about this on page 20.

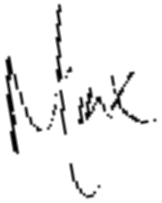
On page 26, we take a look at high-performance computer-based light-harvesting simulations that suggests new ways of optimizing thin-film photovoltaics.

Many power transformers in South Africa operate at and above rated capacity due to rapid growth and development of new industries and residential sites, read more on page 30, in the Power section featuring "Power Transformer Field Testing".

On page 46, Prof. Brading tells us more about the use of decimal numbers with negative placeholders, which is rather interesting.

On the 11th of July, the SAIEE is hosting a Networking Breakfast for ladies in Engineering, at the Sunnyside Park Hotel in Johannesburg. Dr Noel Schultz, who is the Society President at IEEE Power & Energy, USA will be talking to us on how social networking has become a hot topic recently with Facebook, Twitter, Linked In and other web based tools. While these tools are helpful in your career activities, "old school" networking with face-to-face interactions with colleagues is a key to advancing your professional career. During this talk, Dr. Schulz will discuss some tips for creating networks within your professional activities to help support your activities and help you advance in your career. Please contact Gerda Geyer now, to book your space.

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!

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

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

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

**ARTICLES WILL BE JUDGED ON THE FOLLOWING CRITERIA:**

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

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

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

SAIEE
South African Institute of Electrical Engineers

This month the **watt**now is featuring the Engineering Council of South Africa, a statutory organization to regulate the engineering profession in South Africa. Other professional bodies use their statutory bodies to ensure that their profession and status is recognized. We as engineers need to follow this example. There are many of our members that are not registered with the ECSA, and likewise, there are many registered professionals in the electrical discipline that are not enjoying the benefits of being a member of our Institute. Elsewhere in this edition, you will find articles about ECSA.

During the month of May, I had the privilege of visiting the Bloemfontein Interest Group, as well as the Western Cape Centre to present my inauguration address.

The Chairman in Bloemfontein is Ben Kotze. 18 members attended a lunch time meeting, and we were hosted by Eskom Distribution for the event – thanks go to Eskom for this. Ben has sent a separate report on this meeting to **watt**now.

Ben is a senior lecturer at the Central University of Technology, and he gave me a very interesting tour of the engineering faculty. The CUT has 17000 students, 6000 of which are in the engineering faculty, and of the engineers, 1700 are in the electrical discipline. CUT is making good use of technology as the whole campus is Wi-Fi enabled, and all the lectures are placed on their intranet.

The universities of technology play a vital role in providing technologists and technicians. Their education and training is of a very practical nature. CUT seems to be particularly strong in robotics. Industry supports them financially, and students develop practical projects which can be industrialized for future use. These projects are entered into competitions, and they have been the recipient of many prizes.

Another area I found very fascinating was the product development and prototyping department. Besides earning income for CUT by undertaking projects for industry and others, these departments provide practical training opportunities for students, and also enable the students to earn some income. CUT has promised an article on these activities shortly.

I presented my address to the Western Cape Centre on the 10th of May. Prior to the presentation I attended the Centre's monthly committee meeting. The centre is doing well with a full schedule of activities, visits and presentations planned for the year, and are also in a healthy financial position. The presentation was held at the Cape Peninsula University of Technology and was attended by 29 members and students, and was followed by a cocktail party and networking. My thanks to the Centre Chairman, Marius van Rensburg, and his committee who hosted this event.

Kind regards

*Mike Cary* | *SAIEE President 2012*




**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 Christopher Campbell 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**

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# The Engineering Profession must unite to ensure a sustainable and progressive profession

Whilst it is the norm in other countries that the engineering profession, as a collective, comes together under the banner of a non-statutory body to deal with issues that affect the whole of the profession, the absence of such a body has necessitated that the Engineering Council of South Africa (ECSA), assume this role for the good of the profession.

This has not been a unilateral decision but has enjoyed the full support of all recognised Voluntary Associations (VA's) recognised ECSA. Whilst all VA's are driven by their own initiatives to ensure sustainability, rightfully so, I would hasten to add, there are times when it is necessary for the profession to unite rather than adopt a silo mentality towards addressing issues that affect the whole of the profession. Historically this has only happened in times of crisis such as when the new proposed Bill on the Built Environment was brought to the fore a few years ago. Many will recall the frenzy that this caused and the ease with which the profession presented a united front for the good of the country , for the good of its people and for the good of the profession. The time for being reactive has passed and unless the profession presents a united front when the opportunity presents itself, we will forego the opportunity to establish a meaningful partnership with government in the planned infrastructure programme that we have all become aware of following the President's State of the Nation address for 2012 and subsequent presentations made at Provincial level by various Premiers as well as at the recent Economic Development Forum hosted by Minister Ebrahim Patel.

To contextualise this we need to appreciate that the motive for developing more infrastructure is not only to improve service delivery, which admittedly has been an ongoing challenge, but also from the recognition that infrastructure development in its broadest sense is the catalyst for economic growth. It is no secret that this process creates large numbers of jobs and can be used to alleviate hunger and poverty. Though these may appear to be a temporary relief, the longer term attraction of foreign direct investment, developing industries for local beneficiation by growing sectors which affect all engineering disciplines and the need for ongoing operations and maintenance of the infrastructure , not counting the indirect industries which may be developed, create the opportunity for long term sustainable employment in all engineering sectors beyond the capital investment period. The latter could be a way of managing the cyclic nature of the capital investment process and ensure ongoing employment

**Christopher Campbell**
**President**
**Engineering Council of South Africa**

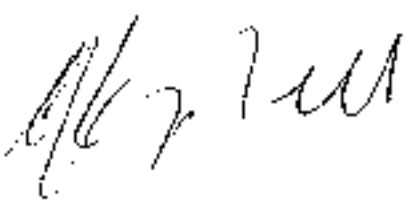
for engineering practitioners between the capital investment cycles.

If we are however to get to the starting point of this process, we have to as a collective embark on a process of working with government in addressing the skills challenge which is not brought about, of necessity by a shortage of engineering skills, though this may be true in certain areas of specialisation, but largely by the inability for technicians, as an example, to graduate, not through any fault of their own, but mostly through difficulty in securing adequate practical training to fulfil the requirements of their study programmes and for engineers to secure employment upon graduation rather than find themselves turning to the financial services sector to fulfil this need. The profession through VA's such as the SAIEE have the ability to directly influence the speed with which these aspirant practitioners may be become registered professionals by embarking on a broad mentorship approach to maximise the numbers of individuals who are eligible for registration in the minimum period normally deemed appropriate after graduation. Municipal infrastructure is after all about at least three core disciplines of engineering, of which Electrical is a key component.

The traditional school of thought may question why ECSA is involved in such areas and why is it not improving on its core business of registration, accreditation and investigation. The response to this is simply, that it is doing all of the above. Currently there is a huge drive to transform ECSA in the broadest sense of the word so that we are able to address this at a people, process and system level.

ECSA itself cannot artificially transform the composition of registered persons by race and gender, an expectation which is erroneously created in certain quarters, but it has started looking at how it can positively influence the pipeline of learners and students at secondary and tertiary levels which then become the candidate engineering practitioners. It is also constantly inviting participation in its various Committees from all VA's and persons in the engineering family and supports the drive by SAIEE in its efforts to encourage broader participation. In addition, whereas the registration process was mostly not visible in the past, it will in the future become more transparent and more visible through the use of technology and improved communication.

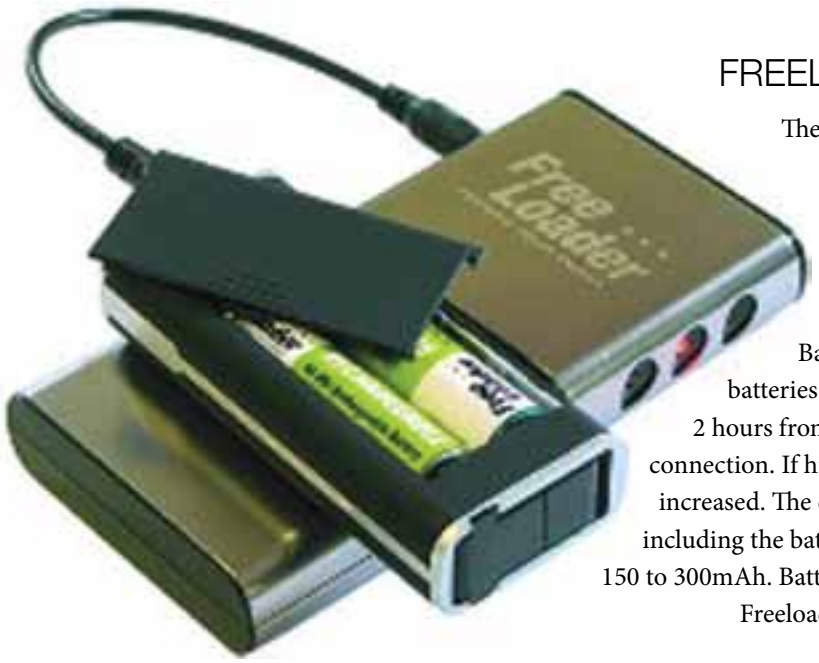
It should be apparent by now that not only does the drive to develop more and more infrastructure create huge amounts of excitement in the industry, but that from an institutional level the challenges are equally exciting if we are to ensure the sustainability of our profession. The participation of SAIEE and all of its members in the efforts of the collective are required now more than ever if we are to overcome all of these challenges and be seen to be the thought leaders for the profession in our developing nation. In closing let us be reminded of a latin phrase " ex nihilo, nihil fit" , which translated means "nothing comes from nothing".



*Christopher Campbell | President | Engineering Council of South Africa*

# WATTSHOT

In this issue, we feature some new and intresting solar products - your bid to save the environment!




## FREELOADER BATTERY CHARGER (AA & AAA)

The Freeloader Battery Charger is a new device for recharging AA batteries and AAA batteries directly from the USB port of a personal computer, or from a Freeloader Solar Charger. It's manufacturers claim this is the smallest and lightest AA and AAA battery charger in the world, and it can be used with both NiMH and NiCd rechargeable batteries. The Freeloader Battery Charger is supplied with two 1,300mah AA rechargeable batteries. These can be charged up to 75% of full charge within just 1 to 2 hours from the Freeloader Solar Charger and in 3 to 4 hours from a USB connection. If higher capacity rechargeables are used then the charging time is increased. The charger is just 85 x 37 x 19mm in size and weighs in at just 54g including the batteries! The input voltage is 5.5 Volts with a charging current of 150 to 300mAh. Battery charge indicators (LEDs) display the charging status of the Freeloader and the power level of the batteries. Retails for R250 (incl.)

## POWERTRAVELLER® STARTMONKEY400 - WORLD'S SMALLEST EMERGENCY JUMP START

The startmonkey400 is a compact, jump-start system suitable for use on both standard cars and larger vehicles such as small commercial vans, 4x4s, etc that have 12Volt batteries (CCA up to 1200A). The startmonkey400 delivers a jump-start current of 12Volts at 400Amps and is packed with high-tech features to give you total peace of mind. The startmonkey400 can restart this type of standard 12 Volt vehicle battery between 15 and 30 times on a full charge thanks to its High Energy Polymer Lithium Battery.

The startmonkey400 features an LCD screen which indicates the condition of the battery. If the voltage is less than 6V, a manual override facility allows the startmonkey400 to jump-start the car battery. Manual override is activated by depressing the black button twice in quick succession.

Leave the startmonkey400 for 5-8 seconds, turn the ignition and your vehicle will start. R2,699 (incl.)

## VEHO™ PEBBLE PORTABLE GADGET CHARGER

Normally when you have a pebble in your pocket you're about to attempt to skim it across a lake to impress a relative's children. You'd be mad to chuck this Pebble Portable Charger into the drink, though - it's a gorgeous and effective way to make sure your electrical bits and pieces are fully charged when you're on the go. Whether it's your iPhone, your digital camera or your mobile phone, the Pebble is all you need to stop yourself from running out of battery on the hop.

Amazingly, the rather delectable Pebble will charge your iPhone fully four times over. Blimey! Imagine that power applied to your other devices and you've got yourself a darned-impressive piece of kit on your hands. You can charge the Pebble up initially via USB using the included cable and check its progress thanks to the capacity indicator lights. There are four connectors that will cheerfully replenish iPhones, iPods, portable games consoles, Sony Ericsson phones, Nokia phones, Blackberries and even mini-USB devices - so basically, you're covered no matter what gadgets you've got on you. Top it off with its own pretty little carry pouch and you've got yourself a most delightful little recharging package. The Pebble Portable Charger is the perfect way to keep yourself topped up, no matter where you happen to be. Selling for R599 (incl.)

## WIKI WATER POWERED RCC CLOCK WITH TEMPERATURE


The WiKi Water Powered clock Version 2, now with radio control, meaning that the clock will automatically set the time from the RCC clock signal worldwide, and temperature display. Powered by water alone, no batteries needed, ever! **Features |** Water Powered **|** No Battery Required **|** Daily Alarm **|** Thermometer °C/°F **|** Worldwide Radio **|** Controlled (USA / Europe / Japan / UK ) **|** 8 languages Day-of-the week **|** Dual Time. Retail for R250 (incl.)


## POCKET SHOWER

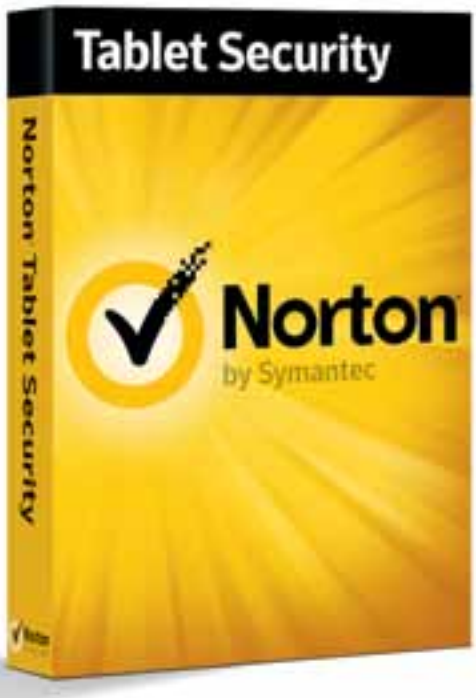
The feeling of being squeaky clean and freshly showered is often a much desired but scarcely achieved goal when tramping about in the great outdoors. Well the distant dream of being able to have a proper shower in the middle of nowhere is now a reality thanks to the pocket shower. This tiny gizmo unfolds to reveal a high performance waterproof reservoir that holds a mighty ten litres of water. The black fabric will (given a sunny day) warm the water up in no time. You just string it up to a tree and open up the attached shower head - hey presto, you can now luxuriate in a seven minute shower, get squeaky clean, and it packs up into a neat package smaller than your fist. Beat the pong with the Pocket Shower. **FEATURES |** A super-compact, take anywhere shower **|** The shower comprises of a reservoir made from high performance waterproof fabric **|** The reservoir has a 10 litre capacity **|** There is a 6m anchoring chord for attaching the shower to a tree or your shower prop of choice **|** The black fabric will attract sunlight and heat the water within in hot weather ensuring a nice warm shower **|** The shower head is contoured with graduated apertures so that you get even spray dispersion **|** 10 litres of water will give you approximately a 7 minute shower **|** Size: 13 x 8 x 4.5cm. Sells for R285 (incl.)

# WATTSHOT

## NEW NORTON TABLET SECURITY PROTECTS AGAINST LOSS, THEFT AND ONLINE THREATS

Norton by Symantec (Nasdaq: SYMC) announced the availability of Norton Tablet Security, including a new "Scream" feature that helps users find a lost or stolen phone quickly. This offering for the Android platform further support the Norton Everywhere initiative, which extends Norton's security expertise and technologies to protect consumers everywhere they go, regardless of device or platform.

"With today's tablets, people stand to risk losing much more than contact information when a device is lost or stolen – it's access to their email, social networking sites, financial institutions or even exposing personal photos or videos, as many celebrities have," said Kara Rawden, Senior Marketing Manager Middle East & Africa, Consumer Business Unit, Symantec. "Given these risks, consumers are increasingly motivated to protect their mobile lives. Norton Tablet Security provides protection from physical and online threats from one of the most trusted brand in security." Norton Tablet Security is available from the Norton Online Store for R299.00, which provides one year of protection.





## SONY MOBILE COMMUNICATIONS INTRODUCES THE XPERIA NXT SERIES

Incorporating the best of Sony technology the Xperia NXT series is a cornerstone of Sony's connected experience. Making the use of four screen technology, consumers can enjoy and share content on whichever screen best suits them, whether it's their smartphone, TV, laptop or tablet.

Xperia S is the first smartphone from the new Xperia NXT series – next generation of Sony smartphones. The Xperia S is an Android smartphone that delivers a stunning viewing experience with a high resolution screen, full Bravia HD, powerful 1.5GHz dual-core processor for faster performance and a 12MP camera with Exmor R sensor that takes pictures in just 1.5 seconds from standby. Available locally from May 2012.

"We are very excited for the launch of the Xperia S in South Africa. We have had a great global response and we are confident that the local consumers will be just as enthusiastic and positive about this device. We at Sony Mobile Communications believe that the Xperia NXT series speaks to the desired target market and will meet the demands of our consumers" said Christian Lonne, Head of Sales at Sony Mobile Communications Middle East and Africa.

Available in your nearest mobile store.

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

# **IDC – a new path** *to development*

Since 1940, the Industrial Development Corporation, South Africa's largest development finance institution, has helped to build the industrial capacity that fuels the country's economic growth, by funding viable businesses.

As the government's key partner in revitalising the economy, the IDC focuses on priority economic sectors that offer the greatest potential to unlock job opportunities.

### *Our vision*

To be the primary driving force of commercially sustainable industrial development and innovation to the benefit of South Africa and the rest of the African continent.

### *Our mission*

The Industrial Development Corporation is a national development institution whose primary objectives are to contribute to the generation of balanced, sustainable economic growth in Africa and to the economic empowerment of the South African population, thereby promoting the economic prosperity of all citizens. The IDC achieves this by promoting entrepreneurship through the building of competitive industries and enterprises based on sound business principles.

### *What we do*

Through partnership, the IDC provides funding in support of industrial capacity development by:

- Proactively identifying and funding high-impact projects
- Leading the creation of viable new industries
- Using our diverse industry expertise to drive growth in priority sectors
- Taking up higher-risk funding in early-stage and high-impact projects

### *What we offer you*

The IDC assists start-up and existing businesses with a minimum funding requirement of R1 million and a maximum of R1 billion. Funding is offered across its mandated sectors under the following Strategic Business Units:

- Agro-Industries
- Chemicals and Allied Industries
- Forestry and Wood Products
- Green Industries
- Healthcare
- Information and Communication Technology
- Media and Motion Pictures
- Metal, Transport and Machinery Products
- Mining and Minerals Beneficiation
- Strategic High Impact Projects and Logistics
- Textiles and Clothing
- Tourism
- Venture Capital

Special **funding schemes** are available that address transformation and entrepreneurial development (TES); topping up equity contributions from entrepreneurs (TES & RCF); and sector-specific schemes (horticulture, forestry, clothing and textiles, hospitals). The IDC Gro-e-Scheme provides funding for projects from R1 million to R1 billion at prime less 3% for up to five years.

The IDC's business support programme addresses non-financial support to entrepreneurs. Assistance is provided with capacity building to improve project viability.

If you have a project that can contribute to building South Africa's industrial capacity and creating jobs, visit **www.idc.co.za** to find out how the IDC can help build your opportunity.



Telephone: **086 069 3888**
Email: **callcentre@idc.co.za**

To apply for funding online visit **www.idc.co.za**

IDC
*Industrial Development Corporation*
***Your partner in development finance***

# WATTSUP

## POWER-GEN AFRICA TO BRING GLOBAL ENERGY PLAYERS & EXPERTISE TO SUB-SAHARAN AFRICA

As the shortage of reserve energy margins in sub-Saharan Africa continues to bring pressure to bear upon the region's economic growth, the region's energy industry leaders and professionals will be looking to the inaugural POWER-GEN Africa conference and exhibition for solutions.

POWER-GEN Africa and the co-located Renewable Energy World Africa event will be held in Johannesburg on 6-8 November 2012 at the Sandton Convention Centre.

According to Nigel Blackaby, Conference Director for PennWell's International Power Group, three conference tracks have been developed in a bid to address the informational needs of all stakeholders in sub-Saharan Africa's power generation industry. These are the Strategic Track and Technology Track of POWER-GEN Africa and alongside them, the Renewable Track of the Renewable Energy World Africa event.

The Strategic Track will address such hot-button topics as Energy Security; Power Sector Regulation; Financing Power Developments; Investment Risk Mitigation; Planning & Operational Challenges; Industrial Power Generation; Capacity Building, Skills & Training; and The Challenge of Rural Electrification.

Topics on the Technology Track agenda include Steam Technology; Gas Turbine Technology; Flexible Power Generation; Fuel Quality Issues; Operations & Maintenance; Emissions Control; Lifetime Extensions and Retrofits; and Performance Optimisation.

The Renewable Track, will bring attention to Renewable Energy Policies for Sustainable African Development; Wind Project Development; The Future for Hydropower; Geothermal Energy; Opportunities Arising from Hydro Rehabilitation, Modernisation and Upgrade; Bioenergy Development – Domestic, Commercial & Industrial; Rural Electrification from Renewable Energy Sources; and Creating and Maintaining a Strong Solar Industry in Africa.

Blackaby says the conference has been awarded a pre-validation, by the South Africa Institute of Electrical Engineers (SAIEE), of 2.5 CPD credits and therefore offers an opportunity for engineers to further their professional education at the same time as networking with their peers.

He adds, "The energy challenges in Sub-Saharan Africa are many and they impact seriously on the overall performance of the region's social and economic indicators. Improving the added value of African products will require modern energy provision for manufacturing, processing, storage and transportation. Energy is also needed for the development of small-scale enterprises, which can contribute to the region's economic survival and growth.

POWER-GEN Africa and Renewable Energy World Africa will look closely at how this can be achieved."

For further information visit www.powergenafrica.com

# Networking Breakfast

The SAIEE is hosting a Women in Electrical Engineering Networking breakfast. You are hereby cordially invited to join us on this funfilled morning. Prizes to be won - don't forget your business cards.

**DATE** 11 July 2012
**VENUE** Sunnypark Hotel, Johannesburg
**TIME** 7:30 for 8:00am
**COST** R275 p/p non-members
R250 p/p SAIEE members

**RSVP** Gerda Geyer - geyerg@saiee.org.za
011 487 9043 - **BY 29 JUNE 2012**

# PNEUDRIVE CHALLENGE 2012 – TAKING POWERFUL ENGINEERING SOFTWARE TO ENGINEERING STUDENTS

The PneuDrive Challenge 2012 Student Engineering Design Competition, sponsored by SEW Eurodrive and FESTO, have implemented workshops designed to reinforce the basics of effective engineering design through their respective software offerings.

South African business regularly raises the lack of effective business skills displayed by young people entering the economy as a challenge. These concerns, unfortunately, are also being expressed in the engineering industry. Once engineering students manage to get over the initial learning gaps in their first couple of years of university, they are then confronted with the reality of needing to apply their theoretical knowledge with an ability to design elegant and effective solutions for real-life engineering problems. Although good design skills are difficult to teach, the challenge of staying in touch with design software and technology that is constantly upgraded and improved can be addressed.

Workshops to introduce students to their respective product selection and design software forms an important extension of the commitment to building bridges between student engineering and business.

This competition, which is in its fifth year and being rolled out to eight South African universities, is an excellent and necessary model of how to bring academic theory and business reality closer together. Rene Rose points out that "this year's theme, "Engineering a Better Life for Communities in South Africa", promises to reveal that young South African engineers have the ideas and commitment to be relevant and competent on a global level".

Businesses do not necessarily need to be involved in how students are taught, but they do need to engage when it comes to providing students with technical, problem-solving and inter-personal learning opportunities that will help them integrate quicker into the economy.

*Professor Anton Basson and a student from Stellenbosch University getting ideas and information from Brian Abbott, FESTO's Pneumatic Product Manager.*

The PneuDrive Challenge has become an important part of the South African engineering student landscape and offers a learning and business model that helps address the need to prepare skilled engineering students for the labour market.

# WATTSUP

## UNIVERSITY OF PRETORIA - DEPARTMENTAL PRIZE GIVING

The Department of Electrical, Electronic and Computer Engineering held its annual prize giving recently. The ceremony was opened by Prof. Roelf Sandenbergh, the Dean of the EBIT Faculty, who encouraged the top achievers to pursue post graduate studies to give them a further advantage in today's competitive environment.

Certificates and cash prizes were awarded to the top three students in the first, second and third year of study during 2011 for each of the three respective disciplines. The top achiever in the third year of study for each of the three disciplines were awarded an additional certificate and cash prize of R800 sponsored by the South African Institute of Electrical Engineers (SAIEE).

These awards were handed over by Mr van Niekerk, deputy president of the SAIEE, who in his address highlighted the importance and benefits of being a member of the SAIEE for one's career as a professional engineer.

Two cash prizes were also sponsored by RapidM for the top three achievers in the two third year courses of Modulation Systems (EMS 310) and Stochastic Communication Systems (ESC 320).

The ceremony was concluded by Prof. Sunil Maharaj, the Head of Deparment, who mentioned the importance of good lecturers in the development of good students in order to improve our international standing as a School and Department.

*Top achievers in the first year of study (l-r): Fahd Lajabu (Electrical), Nicholas Osner (Electronic), Prof. Sunil Maharaj (HoD), Mr. Paul van Niekerk (SAIEE), Renaldo Fibiger (Computer)*

*Top achievers in the second year of study (l-r): Yousef Alkayyali (Electrical), Shruti Lall (Computer), Prof. Sunil Maharaj (HoD), Mr Paul van Niekerk (SAIEE), Piotr Osuch (Electronic)*

*Top achievers in the third year of study (l-r): Pierre Luus (EMS 310 and ESC 320), Jaco van den Bergh (Computer), Mr Paul van Niekerk (SAIEE), Prof. Sunil Maharaj (HoD), Albert Monteith (Electronic), Michael Chennels (Electrical)*

## SAIEE PRESIDENTIAL ADDRESS: DURBAN

The SAIEE KZN Centre recently hosted Michael Cary, the 2012 President of the SAIEE, in order to deliver a repeat of his Presidents Inaugural Address, "Energy Efficiency & Renewable Energy Resources", in Kwa Zulu Natal (KZN). The KZN Centre is in the process of establishing a satellite branch in Pietermaritzburg and the President delivered his Inaugural Address to approximately 40 interested SAIEE members and visitors at the Eskom Mkondeni Conference Centre on 13 June 2012

The President joined the KZN Centre committee members for their committee meeting which was held before the monthly presentation on 14 June 2012. The President updated the committee members on issues of national interest at the committee meeting

The committee meeting was followed by the repeat of the Presidents Inaugural Address to approximately 70 SAIEE members and visitors at the eThekwini Training Centre.


*From L-R: Veer Ramnarain: Vice Chairman of SAIEE KZN Centre; Prof Nelson Ijumba: Deputy Vice Chancellor Research of University of Kwa Zulu Natal; Mrs Cary, Mr Mike Cary, SAIEE President; TC Madikane: Chairman of SAIEE KZN Centre; Dr Pat Naidoo: SAIEE Senior Vice President; Howard Whitehead: Former Head of Electricity: Ethekwini Municipality.*

The Presentation was well received in both Pietermaritzburg and Durban and prompted many questions pertaining to the challenges of energy efficiency and renewable energy resources in South Africa.

*L-R: Tafadzwa Mukwena (Chairman, CESA YPF Gauteng North Branch); Sugen Pillay (CESA Gauteng South Chairman); Andre van der Walt (CESA Gauteng North Chairman); Graham Pirie (CESA CEO); Nazir Alli ( Guest Speaker and SANRAL CEO); Naren Bhojaram (CESA President).*

# 'CESA ENGINEERS – UNQUESTIONABLY ETHICAL'

Consulting Engineers South Africa's (CESA) new President Naren Bhojaram, presented his presidential message and theme for the year at a function held in Johannesburg. With a theme of 'CESA Engineers – Unquestionably Ethical', Bhojaram addressed the global issues impacting the industry; the state of the Consulting Sector; the Procurement Environment; and delivery models to enhance job creation with a strong emphasis on Business Integrity and the eradication of corruption. He also addressed the 'one thing we can all do to grow our economy'.

With the work of the National Planning Commission; the development of the New Growth Path; as well as the accord signed between Government, labour, civil society and business in 2011, Bhojaram states that what Government is planning in order to stimulate the economy is commendable but plans need to be put into action. Bhojaram urges the Minister of Economic Development, Mr. Ebrahim Patel to urgently consider the Consulting Engineering Sector as a designated sector for local preference ensuring a better platform for job creation, attracting young people to join the sector thus accelerating training and development.

In order to encourage private sector to invest in the development of infrastructure projects Bhojaram believes that we need to be entrepreneurial about project delivery mechanisms. The easing of Public Private Partnership regulations will facilitate this. CESA is willing to actively participate in order to accelerate service delivery and job creation. "We will continue to bring top of the mind awareness to our members and individuals in our industry to continuously explore their personal ethical balance so that we remain "CESA Engineers – Unquestionably Ethical" concluded Bhojaram.

# Taking Up The Design Challenge

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

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

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

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

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

## TAKE IT FURTHER

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

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

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

# Solarpanel Boat

In Spring 2004, the seed of a little crazy idea germinated in the mind of Raphael Domjan, a 39 years old native of Switzerland. He is a qualified electronics engineer but in his free time, enjoys being an ambulance man, jet and glider pilot and a mountain guide. In love with nature, he is a Jack of all trades and a fervent defender of clean energy. Like others, he feels that we rapidly need to find alternatives for our wild oil consumption but, at the same time, the huge potential of renewable energy still need to be proven and promoted.

**COMPILED BY I** MINX AVRABOS

Unknown to the general public but a citizen of the world, Raphael then imagines an extraordinary adventure inspired by his reading of Jules Verne's novels: *Travelling around the world aboard a ship which is being propelled by solar energy only!* An ecological and technological journey that seems feasible to him but no one has ever tried. There is plenty to do in seeking partnerships, putting a team together and most importantly - design a ship…

The dream starts taking shape in February 2008 thanks to a meeting with M. Immo Ströher who has a long-standing interest in solar technology and possesses a solid experience in that matter. The German businessman and the Swiss Phileas Fogg became business partners. By combining their capital, their ideas and their inexhaustible energy, Raphaël Domjan and Immo Ströher wanted to demonstrate that a motor vessel of today can function without using any fossil fuel and that the clean and eco-aware navigation has undoubtedly a commercial future. After two years of designing and assembling in Kiel's shipyards, this idea became a project that resulted in a boat which remains unique so far: the Tûranor PlanetSolar.

Beyond the dream and the emotion that this adventure created, the PlanetSolar project brought an international team together which consisted of physicians, engineers, shipbuilders and sailors who contributed day after day, miles after mile, to the success of the first trip around the world using onlyy solar energy.

The designer of PlanetSolar, Craig Loomes from New Zealand, imagined numerous innovative ships around the world. Several months of research enabled him to finish the ideal dimensions and design of this double hull vessel with respect to the chosen journey. Engineers had to optimise the energy collection and stocking but also the aerodynamics, the ship's propulsion and the choice of materials.

The incredibly light carbon structure of this futuristic vessel with electric motorisation is extremely durable.

PlanetSolar is the biggest solar ship in the world. The 537m$^2$ of photovoltaic panels, powers 6 blocks of lithium-ion battery, a technology that offers maximal power and energy density, thus enabling a navigation

time that is unmatched to date! Indeed, each new sunrise provided the catamaran with the light needed to continue its journey…

Baptised 'Tûranor PlanetSolar', which means *Power of the Sun* in J.R.R Tolkien mythology, this clean and quiet vessel was launched in March 2010 in Kiel, Germany, in the shipyards of Knierim Yachtbauafter, 14 months of construction.

TECHNOLOGY

"PlanetSolar" is a catamaran that runs solely on energy found in light. The additional removable parts allow it to expose a total of 537m² of photovoltaic surface (solar panels) to the sun. This impressive data make it the biggest solar run ship in the world. wn

*For more info, visit www.planetsolar.org*

## TECHNICAL DETAILS:

| | |
|---|---|
| Length: 31m | Width: 15m |
| Length with flaps: 35m | Width with flaps: 23m |
| Height: 6,10m | Draft: 1,55m |
| Weight: 95t | |
| Surface area of solar modules: 537 $m^2$ | PV panel efficiency: 18.8 % |
| Installed PV power: 93.5 kW (127.0 HP) | Puissance moteur maximale: 120 kW |
| Average engine consumption: 20 kW (26.8 HP) | Autonomy: never-ending solar navigation |
| Crew: 4 personnes | Number of people that can go on board: 40 |

Earn CPD Credits

Many clients ask their electrical consultants or architects about rooftop mounted solar PV (photovoltaic) systems. They have heard about it, read about it or formed an opinion about it. Usually these enquiries are made because the client wants to "go green" or "go off-grid" and they want to know if PV can work for them and most importantly, what it would cost. When faced with these questions, the consultant may not know where to turn for information as experience in this field is usually limited. This article will give the reader a basic understanding of what a solar PV system can offer to their clients, be it commercial or residential.

## GRID-TIED PV SYSTEM BASICS

Before we evaluate the benefit to a client from a Solar PV installation, let's have a look at the basics of a grid-tied solar PV system:

1. This might a bit too basic for some readers, but it is surprising how many people do not know this: a PV system only generates power when the sun is shining. When incident light on the PV modules are 90 degrees, the production is at its peak and gets less and less as the sun moves towards the horizon. It is therefore not a base-load generator. The DC power generated then is converted into AC power by inverters.

2. Power generated by a'n solar PV system cannot be stored without batteries. If you do not use the power generated by the solar PV system, the excess power generated will run back into the grid. Remember, electrical power can flow in different directions. It doesn't always have to flow from the grid to the consumer.

3. The grid is your friend. In order to cater for the fact that the generated power is not storable, one has to install batteries or generate in parallel to the utility grid. This will ensure that the grid will pick up the slack when the PV system is not generating exactly what your usage requires. A grid-tied system is much cheaper when batteries are not included. Let's rather work with the grid, than try to be independent of it. The idea is only to use less of it!

4. A grid-tied system is, as the name implies, connected to the Eskom grid. It generates power in parallel with the grid. If you connect such a system into a low-voltage panel on the client's premises, it is still a grid-connected system. It is almost

SOLAR POWER 101

# "The Grid is your friend"

**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"

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as they say in the Matrix movie: the grid ("Matrix") is everywhere. This is different from having a diesel standby generator in that such a generator will disconnect the entire building electricity supply from the grid until the power comes back on. It will generate power to keep the building, or parts thereof, running while the grid is off and it cannot feed power back onto the grid, as it is isolated from it.

5. If you connect a grid-tied PV generator to the utility grid, you have to own an electricity generation license from NERSA. No getting around this one. The utility (either Eskom or the municipality) must also give their consent and associated agreements will have to be entered into. Some municipalities do not allow this kind of connection at all, but sadly many contractors still connect these systems without the proper authorisation and they still maintain that they are allowed to do so.

6. A grid-tied solar PV inverter will disconnect from the utility grid and stop generating when the power goes off. This is to protect against "islanding", in which case technical support personnel working on power lines can be electrocuted during maintenance operations, if a solar PV system generates power into a grid that is apparently off. For this very reason a solar PV grid-tied system is NOT an emergency backup system. The capital outlay is too much to class it as an emergency supply anyway. A diesel generator is a much better (read: cheaper) option -- albeit a much less green one. A solar PV system is an "energy saving" solution. The power of it lies in the annual savings you see on the clients' electricity bill.

7. Installed power is not necessarily equal to power that will be produced. Many factors play a part here: weather, solar irradiation for the specific location, soiling on the modules, shading, etc.

8. Peak power is not necessarily what constitutes the energy saving – the kilowatt-hours produced will bring the saving – i.e. the integral of the daily peak generating curve of the system. If the building's maximum power (kW) demand coincides with the peak production of the PV plant, peak power savings may be realised, if managed carefully. Remember, if a building uses its peak power for only a minute, they will be billed for the peak usage, even though it never uses as much for the remainder of the month. But again, this also depends on the tariff structure of the customer.

## TO PV OR NOT TO PV, THAT IS THE QUESTION

Now that we are clear on the basics, we can evaluate the client's request. Property developers and building owners are usually surprised to learn that PV might not be the right solution to their energy woes. This is especially true when a PV system expert advises them to rather steer clear. When evaluating a property to find a suitable PV solution, if one exists, a couple of questions need to be answered:

- *Is the client ready for a PV system solution?*
  If the answer to this question includes "because it worked for so-and-so down the road", "I've heard that the price has come down considerably", "I don't want to pay Eskom more than what is absolutely necessary" or "I want to go off-grid" then a Solar PV solution may not be the best solution for this client. The reason for this is simple: price. Even though prices have dropped considerably during the last few years, a solar PV system still requires a very healthy amount of capital expenditure. If the client wants to be off-grid, batteries will make the system unaffordable. If the client does not have a clear understanding of what they want to do about excessive energy bills, they should rather consider other energy saving schemes first. Pick the lowest-hanging fruit first, so to speak.

- *Does the client have sufficient roof space that faces north and that are clear of excessive shading?*
  Of course, in the southern hemisphere, we get most of our sun from the north. Many installers mount PV modules on a south facing roof (really!), or in areas with excessive shading. This would be a waste

*If the client does not have a clear understanding of what they want to do about excessive energy bills, they should rather consider other energy saving schemes first.*

of money. If a client wants to spend the money to install a PV system, this system must be exposed to as much sun as possible, to maximise return on investment. One needs to evaluate if the roof structure can handle the installation, too.

- *If we do manage to generate energy with sunlight, how will the power get distributed?* Are there low- or medium-voltage distribution boards/rooms close to where the modules have been mounted? If this is not the case system cost could increase.

- *In order to ensure that excess power do not flow into the grid the peak rating of the system needs to coincide with the lowest peak demand of the client.* For example, a client's maximum demand may be 2MW and his minimum demand may be 500kW. If a 2MW(peak) solar PV system is installed, power will flow from the generator into the grid during the low-usage months and the client will not get the benefit from it. If the arrangement with the utility is that the power fed into the grid will be paid for, then of course it is a whole different story. For this article we assume that the end requirement is self-consumption.

- *The estimated energy (kWh) yield of the system needs to be evaluated by using proper solar yield calculation software.* If this value is multiplied by the tariff payable by the client, this will give an indication of how much the client could possibly save on their energy bill. Upon these calculations the financial case for the projects gets built. And, of course, on which the decision to proceed can be based.

Once all of these issues have been evaluated, a solar PV system can be sized, designed, procured and installed. But this is a topic for another article.

# Solar & Alternative Energy

## HIGH-PERFORMANCE COMPUTING SIMULATES LIGHT TRAPPING IN SOLAR CELLS

High-performance computer-based light-harvesting simulations suggest new ways of optimizing thin-film photovoltaics.

**BY** | CHRISTOPH PFLAUM | CHRISTINE JANDL

Sophisticated light management is crucial for optimal thin-film solar cell efficiency.[1] One successful approach, based on nanostructured composite layers and illustrated in Figure 1, incorporates materials with highly optimized optical properties. As might be expected, the design, development, and testing of these new solar cell prototypes is a time-consuming process. For this reason, suitable models and simulation techniques are required for the analysis of optical properties within thin-film solar cells.[2] These can be widely applied to nanostructure designs and may include ray tracing, optical admittance analysis, a transfer matrix method, or finite difference discretization of Maxwell's equations.

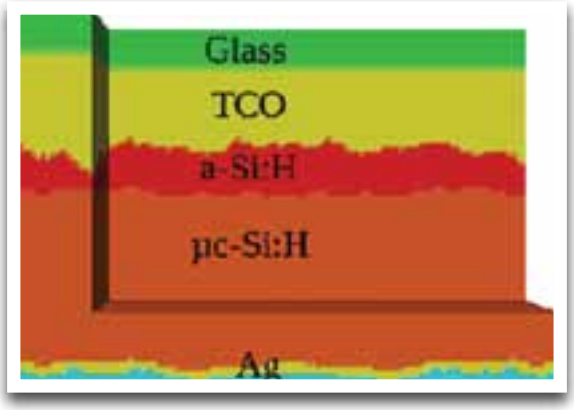


*Figure 1. Structure of a thin-film solar cell. Onto a rough silver (Ag) surface are deposited, in order, transparent conductive oxide (TCO), microcrystalline and amorphous silicon µc-Si:H and a-Si:H, respectively, a second layer of TCO, and glass.*

The latter leads to the most accurate simulations because it includes optical effects such as interference, optical near-field properties, and plasmon effects. Suitable discretization methods are finite edge elements (FE), the finite integration technique (FIT), and finite difference time domain (FDTD). However, these approaches are all computationally intensive owing to the difficulty of achieving the randomness of rough interfaces between composite layers formed on rough metallic surfaces.

We have developed a simulation tool for calculating quantum efficiency and short-circuit current density of thin-film solar cells. We use the FIT method since it can be used for curvilinear interfaces and is less computationally intensive compared with FE. We optimized the software using the standard message-passing interface (MPI) to harness the power of several thousand processors. The topography of interfaces between different layers used to build our simulation uses data from atomic force microscopy (AFM) scans of real surfaces. For the simulation itself, suitable boundary conditions must be defined to handle the non-periodic structure of the AFM scan data. We modelled sunlight for different polarizations and oblique incident light, and carried out simulations in parallel nodes for a given solar spectrum. The simulation also takes account of the absorption of light in different layers of the solar cell.

To simulate materials with negative permittivity at visible wavelengths, such as the silver used to back the thin film, we used a time harmonic inverse iteration method. Silver and other noble metals metals have negative permittivity because they are opaque to electromagnetic waves at visible wavelengths. But at shorter wavelengths electromagnetic waves are above the resonant frequency of the material and begin to pass through it. We use our time harmonic inverse iteration method[3] to

# Solar & Alternative Energy

*continues from page 27*

predict the paths of electromagnetic waves as they pass through the material. 'Time harmonic' relates to the fact that we are dealing with the time-dependent partial derivative of Maxwell's equations in a periodic (harmonic) treatment. This solves Maxwell's equation for a given frequency without requiring a 'Drude' approximation of the permittivity of the material. In other words, the refractive index and absorption of silver do not have to be approximated as they do for other methods.[4]

As an example, we simulated a tandem thin-film solar cell consisting of one layer of amorphous silicon (a-Si:H) and one layer of microcrystalline silicon (µc-Si) (see Figure 1), with the aim of analyzing the effect of adding a back transparent conductive oxide (TCO) and silver back contact. It is widely known in the field that plasmonic effects at the silver-backed contact influence the short-circuit current density. The plasmonic effects themselves are in turn influenced by the surface roughness of the silver layer, which we measured using AFM.

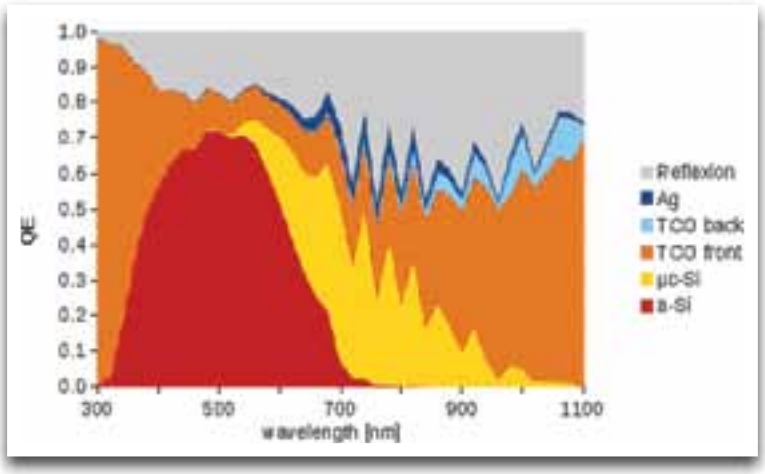


*Figure 2. Absorption, loss, and reflection in a tandem thin-film solar cell. The computational domain was a cube of size 3.5µm in all directions. The solar spectrum was covered by 41 wavelengths from 300–1100nm. QE is quantum efficiency.*

To optimize the back contact, we explored a number of different composite architectures, including with and without the TCO back layer, and for smooth and rough surfaces of the silver back contact. Our simulations showed that a TCO back layer is essential for obtaining a high short-circuit current density. However, while the roughness of the silver back contact has a minimal effect on the total short-circuit current density, that of the TCO back layer contact can strongly influence the efficiency of the solar cell. Figure 2 shows absorption, loss, and reflection of a solar cell with a TCO back contact incorporating AFM scans of real interfaces. The numerical simulations were performed on the high-performance Lima Computer Cluster in Erlangen, Germany, using 1536 processors.

Our next steps are to analyze the optimal structure of the TCO back layer compared with the structure of the front TCO layer. This can be done by applying and comparing modified AFM scan topologies, measured from real samples. We will then compare real prototypes of our theoretically optimized solar cells to check the validity of our model.

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Christoph Pflaum was awarded a technical degree in mathematics and electrical engineering in 1992 at the Technical University of Munich, and a PhD in mathematics at the same university in 1996. From 2003 he has been professor of high-performance computing at the University of Erlangen-Nürnberg. WN

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*Source: *BTM Consult ApS – A part of Navigant Consulting – World Market Update 2010*

Earn CPD Credits

# Power Transformer Field Testing

**COLD COMMISSIONING, MAINTENANCE TESTING AND TESTING AFTER A FAULT**

Many power transformers in South Africa operate at and above rated capacity due to rapid growth and development of new industries and residential sites. Over the past 15 years very little or no maintenance has been done on many of these units. We are thus faced with the aging of a large number of transformers on the supply networks with a supply demand that is rapidly increasing. Over the last 8 years many utilities have embarked on a process of replacing old transformers with new.

**BY |** DEON STEYN **|** PR. CERT. ENGINEER

Transformer manufacturers are being forced to design to the limits of specification to remain competitive in the market place. Due to the demand for power transformers in South Africa new transformers are being sourced from all over the globe. To ensure that these transformers reach and exceed their design life reliable test technologies, techniques and analysis need to be implemented via adequate electrical maintenance programs and processes. The evolution of test technologies and test equipment has provided means for quick testing, diagnosis and analysis of test results and transformer condition. Due to improved test equipment design traditional tests that have required long times to complete have been drastically shortened reducing outage time. Developments in test equipment software have provided ease of analysis and database entry to facilitate trending and comparison to commissioning (thumbprint), maintenance and factory test values. Test Equipment manufacturers such as Doble, Omicron, Megger etc. also have the expertise, experience and knowledge to provide diagnostic and analytic services when needed to assist in making the correct decisions where SFRA (Swept Frequency Response Analysis), FDS (Frequency Domain Spectrometry) and other sophisticated tests are performed.

The purpose of this article is to provide insight into the electrical tests that are performed on site. Case studies are also given.

# Power Transformer Field Testing

*continues from page 31*

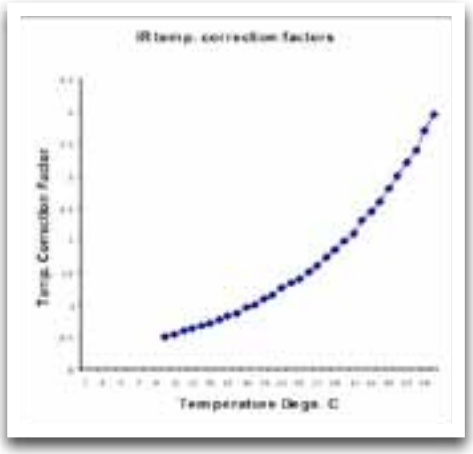
## ELECTRICAL FIELD TESTING OF POWER TRANSFORMERS.

### *When should transformers be tested?*

- Testing of transformers takes place firstly at the manufacturers' works where a competent person should witness the tests from the user. Here tests are witnessed and test certificates mutually signed by the manufacturer and user.
- The following describes commissioning tests, which are performed on site to ensure that no damage has occurred to the transformer during transit. Test results prior to transit are correlated to tests performed after installation to assess possible damage. Whenever a transformer is moved from one location to another, comprehensive tests must be performed before and after installation of transformer.
- Tests must be performed during preventive maintenance work as part of an effective electrical maintenance program so that the condition of the transformer can be monitored by trend analysis and verification of any repairs can be checked. Any incipient faults can at this stage be located and repaired before any failures occur.
- Tests are also performed on the transformer after it has tripped as a result of a fault via the Bucholtz relay, restricted earth fault, etc. This test is to verify the damage if any, or whether the unit may be safely returned to service.
- Tests performed on site.

All applied tests listed are Non- Destructive. A full compendium of tests is required to make useful interpretation of incipient problems that will lead to ultimate failure.

## INSULATION RESISTANCE TEST (DC TEST)

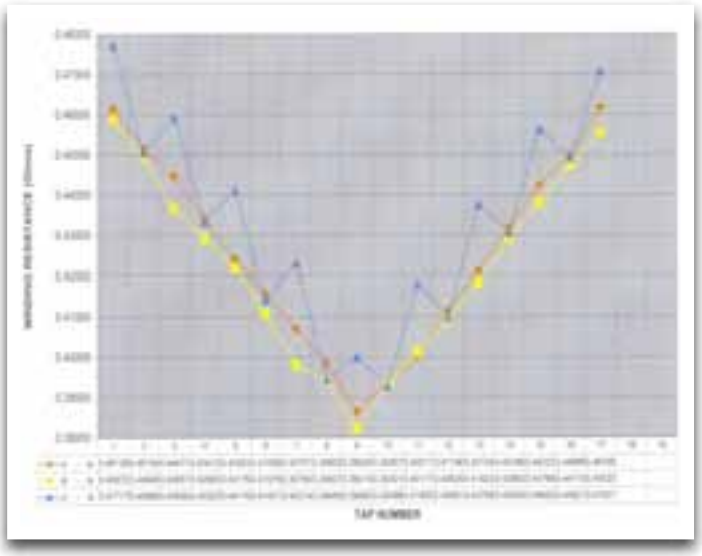



Insulation Resistance (IR) test can be of use when determining the presence of contaminants or deterioration in the insulation system. Unfortunately there are variables, which may make it difficult when required to interpret these test results. IR is temperature dependant and when measured at higher temperatures will give decreased values of IR. To ensure useful interpretation of test results, tests should be done at the same temperature, which is not always practical. Correction factors are available for converting to a common temperature of 20° C. when performing the test at different temperatures.

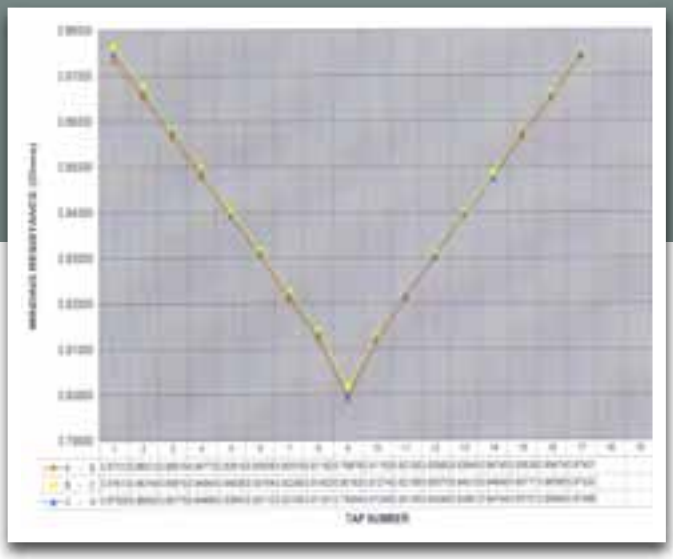
Humidity and leakage currents flowing along the outside surfaces of insulators or bushings can also provide false information. Bushings and insulators need to be thoroughly cleaned before testing. The current flow through an insulation system consists of a charging current, which starts at a high value and decreases until the capacitance of the insulation has been fully charged by the applied voltage. The dielectric absorption current results from absorption within imperfect dielectrics caused by various polarisations. The leakage current is the most important component in evaluating the condition of insulation. IR test measurements are generally taken between HV to Earth, MV to Earth and HV to MV the testing period being one minute.

## WINDING RESISTANCE TEST (DC TEST)

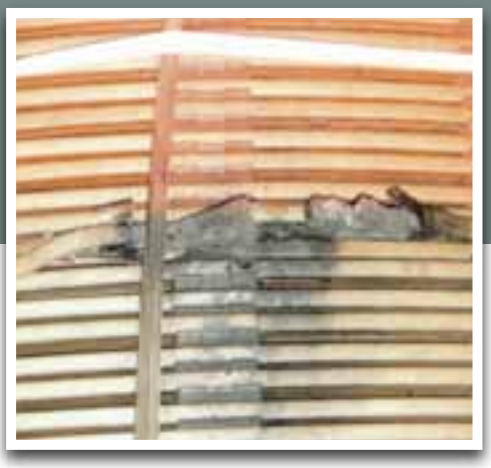
This test is performed during commissioning, preventive maintenance and after fault trips. It is one of the most useful tests in determining bad or loose connections on tap changers, bushings, broken strands, shorted turns and high resistance contacts in tap changers. This test also provides information related to the mechanical condition of the transformer. Where available winding resistance values should be compared to the original factory



***Carbonised contact on changeover switch (odd taps) found in tap-changer after PM winding resistance test.***



*Results acceptable. Winding resistance performed during commissioning tests*



*Inter-turn fault, verified by comparison of commissioning winding resistance tests and tests after a fault trip*

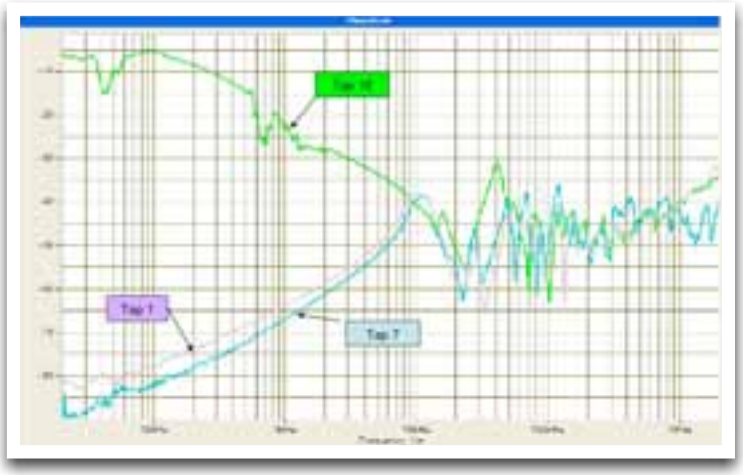
tests, site commissioning tests or previous maintenance test results. If not available comparison can be made between phases or between phases and neutral where possible.

To determine the condition of the tap changer contact resistances, tests should be performed on all tap positions. Due to the temperature coefficient of resistance of copper and aluminium and the extremely low resistance values being measured (milliohms) it is advisable that resistance measurements be converted to the reference temperature used in the factory (this is normally based on 75° C) when comparisons are made.

These measurements are made using the four wire 'Kelvin-principal' to eliminate inaccuracies that may be caused by the length (resistance) of the test leads. Modern equipment allows for quick saturation of the core reducing test time to a couple of minutes per tap.

Due to the large inductance of the winding great care must be taken when discharging the circuit after testing. A large back emf could cause a fatality if not properly discharged, many of the more modern type instruments discharge the circuit automatically. It must be clearly noted that should magnetising current tests or SFRA be required they should be done prior to the winding resistance test as residual magnetism will remain in the core and distort the magnetising currents making them meaningless. This test is a useful means of evaluating problems and should also be used as an integral part of a routine maintenance program.

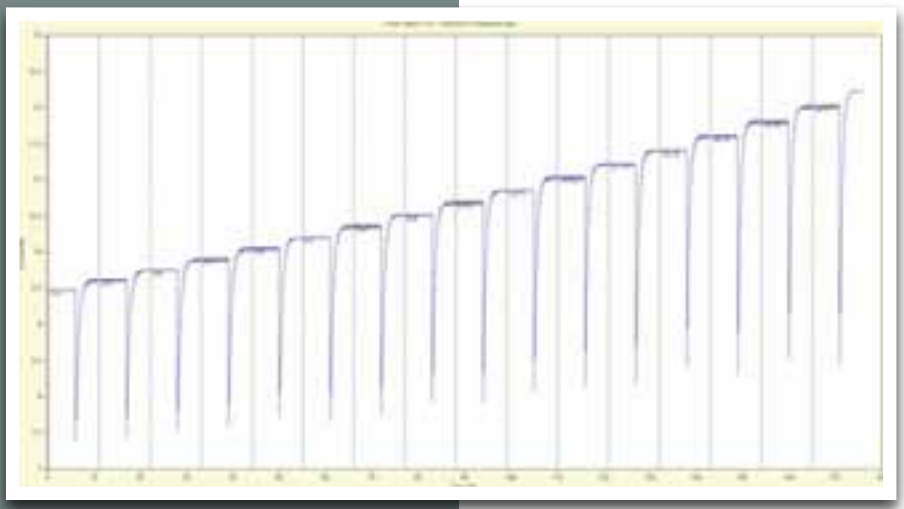
***This problem may have caused eminent failure if the unit had it not been removed for maintenance testing.***



*Correlation between SFRA and winding resistance test. Transformer tapchanger contacts were found to be damaged, extremely dirty and making poor contact.*

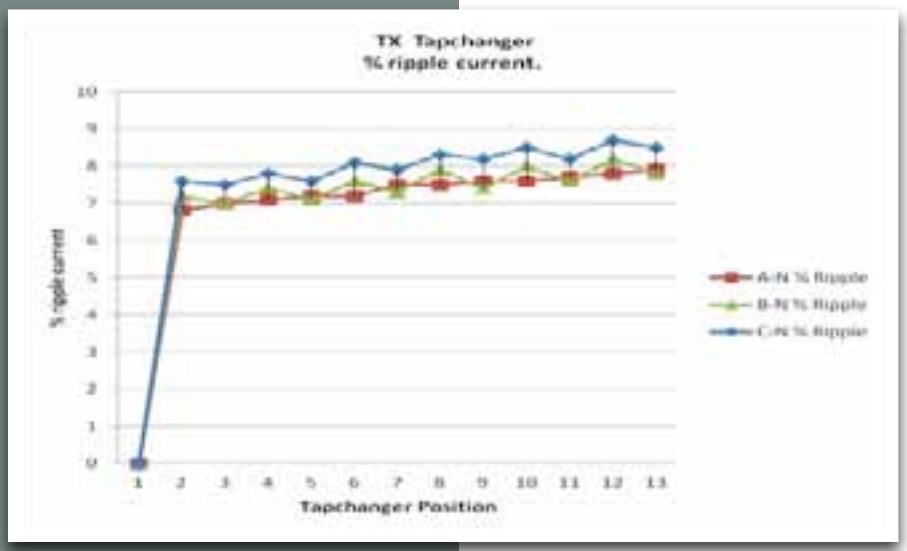
# Power Transformer Field Testing

*continues from page 33*



## TAPCHANGER DYNAMIC RESISTANCE TEST

Modern Winding resistance test set also enables the tapchanger transition period to be measured as well as the % ripple current during change over of the tap position. Results are captured allowing for analysis and comparison to benchmark and previous tests. These tests should be done after tapchanger maintenance and compared to previous results - an essential test before and after maintenance on a tapchanger.




## TRANSFORMER VOLTAGE RATIO, POLARITY AND VECTOR GROUP VERIFICATION TEST (AC TEST)

A specialised transformer ratiometer (TTR instrument) is used for these tests. For commissioning tests, to ensure measured ratios are within specified limits usually within ± 0.5% of those calculated from nameplate voltage ratio and to ensure vector group as per nameplate is correct. The measured ratio must compare with the calculated ratio on any given tap to within ± 0.5%. The test ensures internal connections are correct and no short-circuited turns exist.

During preventive maintenance tests or after transformer repairs the test is done covering all tapping positions to identify shorted turns, incorrect tap settings, errors in tap counters, misaligned tap connecting shaft, mislabelled phase markings and failures in tap changers. An essential test after maintenance on tapchanger.

After a fault trip the test will detect shorted turns within the transformer, which indicates, insulation failures if the correct voltage ratios are not obtained. Modern ratio meters have the capability of finding the vector group if this is not known. Magnetising currents and phase angle are given to assist in diagnosis.

When connecting test leads ensure that the high voltage-winding phase corresponds to its particular winding phase on the low voltage winding as given on the nameplate phasor diagram. Turns ratios must be calculated using voltage ratio values. Test is done covering all tapping positions and ensuring compliance with specification.

PURPOSE OF TEST: Test after Bucholtz trip.

REMARKS :

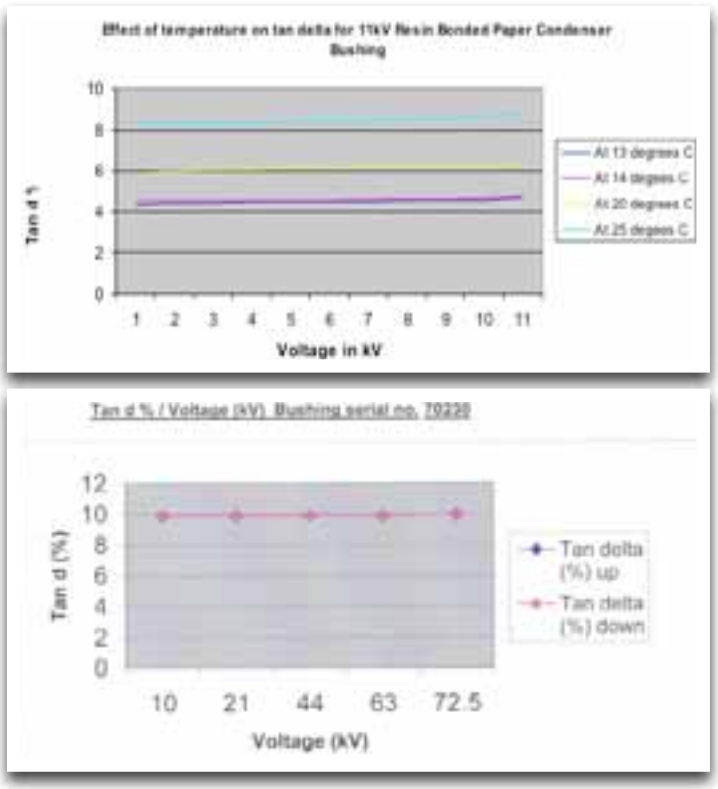
| Name Plate Data | | | Primary Winding | | | Secon. Winding | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Make | | | Voltage | 33000V | | Voltage | 6600V | Freq.(Hz) | 50 | Oil Mass (l) 9310 |
| | Rating (kVA) | 15000 | | Current | 262.5 | | Current | 1312 | Imp V (%) | 10.8 | |
| | Serial Number | | | Phases | 3 | | Phases | 3 | Vect. Sym. | Dyn11 | |
| | Year of mnf. | 1977 | | Conn. | Delta | | Conn. | Star | Spec. | BSS 171-1970 | |

| TAP No: | HV WDG Line Volts | LV WDG Line Volts | TEST CONNECTIONS | | | | | | | Tol. | Magnetising Currents | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | POLAR. | + - | | + - | | + - | | | Phase A | Phase B | Phase C |
| | | | HV Wdg. | A - B | | B - C | | C - A | | | | | |
| | | | LV Wdg. | a - n | | b - n | | c - n | | Accept. | | | |
| | | | Calc. R. | Meas. R. | % Diff | Meas. R. | % Diff | Meas. R | % Diff | Yes/No | (mA) | (mA) | (mA) |
| 1 | 34980 | 6600 | 9.1796 | 9.616 | 4.5333 | 9.2744 | 0.0014 | 9.2791 | 1.0839 | No | 259.9 | 68.1 | 68 |
| 2 | 34485 | 6600 | 9.0497 | 9.4864 | 4.6034 | 9.1458 | 0.0015 | 9.1502 | 1.1105 | No | 266.4 | 70 | 69.9 |
| 3 | 33990 | 6600 | 8.9198 | 9.3606 | 4.7091 | 9.0205 | 0.0015 | 9.0249 | 1.1783 | No | 274.2 | 72.1 | 71.9 |
| 4 | 33495 | 6600 | 8.7899 | 9.2339 | 4.8084 | 8.8929 | 0.0016 | 8.897 | 1.2184 | No | 280.9 | 74 | 73.9 |
| 5 | 33000 | 6600 | 8.6600 | 9.1045 | 4.8822 | 8.765 | 0.0016 | 8.7687 | 1.2552 | No | 288.6 | 76 | 75.9 |
| 6 | 32505 | 6600 | 8.5301 | 8.9749 | 4.9560 | 8.6367 | 0.0016 | 8.6407 | 1.2966 | No | 296.7 | 78.3 | 78.1 |
| 7 | 32010 | 6600 | 8.4002 | 8.8462 | 5.0417 | 8.5095 | 0.0017 | 8.513 | 1.3428 | No | 305.8 | 80.9 | 80.7 |
| 8 | 31515 | 6600 | 8.2703 | 8.7163 | 5.1169 | 8.3814 | 0.0017 | 8.3848 | 1.3845 | No | 314.1 | 83.2 | 83.1 |
| 9 | 31020 | 6600 | 8.1404 | 8.5859 | 5.1887 | 8.253 | 0.0017 | 8.2564 | 1.4250 | No | 324.9 | 86.2 | 85.9 |
| 10 | 30525 | 6600 | 8.0105 | 8.4562 | 5.2707 | 8.1247 | 0.0017 | 8.1282 | 1.4693 | No | 331.3 | 88 | 87.8 |
| 11 | 30000 | 6600 | 7.8727 | 8.325 | 5.4327 | 7.9962 | 0.0019 | 7.9994 | 1.6090 | No | 342.9 | 91 | 90.7 |
| 12 | 29535 | 6600 | 7.7507 | 8.1937 | 5.4066 | 7.8681 | 0.0018 | 7.8716 | 1.5599 | No | 352.9 | 94 | 93.8 |
| | | | | | | | | | | | | | |

This test is a useful means of evaluating problems and should also be used as an integral part of a routine maintenance program. Vector group verification must precede paralleling of transformers. The magnetising current method is much more sensitive to use when seeking shorted turns and should be used to confirm the results of the turns ratio test.

## INSULATION DISSIPATION FACTOR (TAN DELTA) AND CAPACITANCE TESTING (AC TEST)

This test is performed during commissioning, preventive maintenance and after fault trips. The test indicates the state of dryness of the windings and the insulation system as a whole, including bushings, oil and windings. The dissipation factor is a measure of the ratio of the true power (P) and the reactive power (Q) in the insulation of the transformer. Tan delta is the tangent of the loss angle between the resistive current and the capacitive current in the dielectric. The tan delta and capacitance test measures the insulation capacitance and the tangent of the loss angle from which the dielectric loss can be calculated. The $I^2R$ losses will produce heat in the insulation system during operation of the transformer. Heat together with moisture and oxygen will cause deterioration in the insulation reducing the lifespan of the transformer.




***Tan delta value of an 11kV Resin Bonded Condenser Bushing unacceptable at 10% at 10 kV***

# Power Transformer Field Testing

*continues from page 35*

The values obtained for each test are compared to factory test results, commissioning "thumbprint" tests and preventive maintenance test results. Trending can therefore be done as the transformer insulation system ages. The capacitance and tan delta test measures the capacitance and dissipation factor between the high and low voltage windings, between the high voltage winding and tank (earth) and the low voltage winding and tank (earth).

New transformers generally have a tan delta value of 0.5% or less. Temperature affects tan delta measurements and temperature correction factors need to be applied when testing at temperatures other than 20° C, especially when comparison needs to be made from previous results. This test is particularly useful in showing changes in the winding due to lighting strikes and through faults where winding movement and deformation may have occurred (capacitance measurement). The test provides information to assess the dielectric condition of the transformer insulation.

In condenser type bushings changes in capacitance measurements could be attributed to tree formation between stress grading foils in the bushing insulation. High tan delta values may be the result of moisture ingress and/or oil contamination in the bushing insulation system.

## EXCITATION / MAGNETISING CURRENT TEST

This test is performed during commissioning, preventive maintenance and after fault trips. The purpose of this test is to detect poor electrical connections, inter-turn shorts, gross core damage and winding problems. It provides information for mechanical assessment of transformer. On three phase transformers the results are compared between phases. The magnetising current will be much greater on the phase with the shorted turns. In general the outer limbs of the core of a core type transformer will have similar magnetising currents whilst that of the centre limb will be slightly less, this when no faults are present in the transformer.

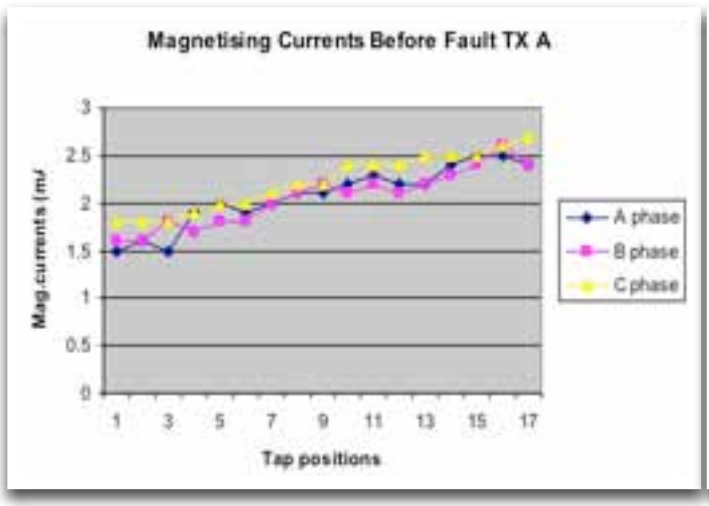
## CORE GROUND TEST (DC TEST)

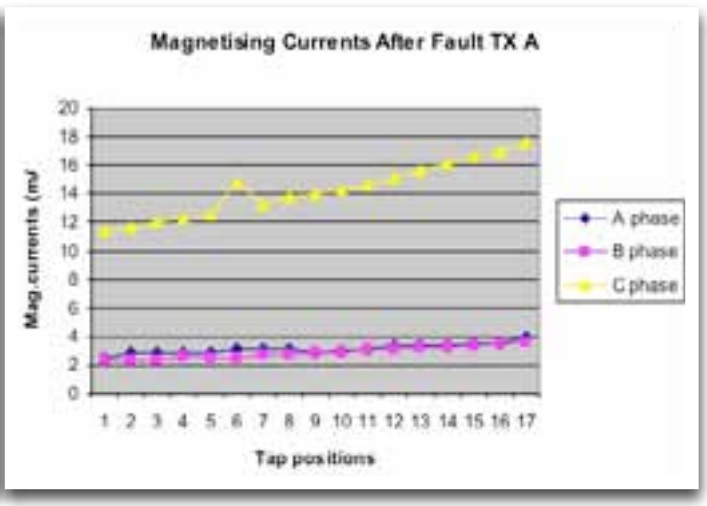
This test is performed during commissioning, preventive maintenance and after fault trips.

If an unintentional core ground is suspected then a core insulation resistance test must be performed. The core is grounded at one location. If an unintentional core ground is formed in another location, circulating currents will flow between the core and ground causing internal heating within the transformer. Dissolved gas analysis will show the production of combust ethane and / or ethylene and possibly methane. To do the measurement the intentional core ground connection must be disconnected, an insulation resistance measurement must be done between the now insulated cores to ground.

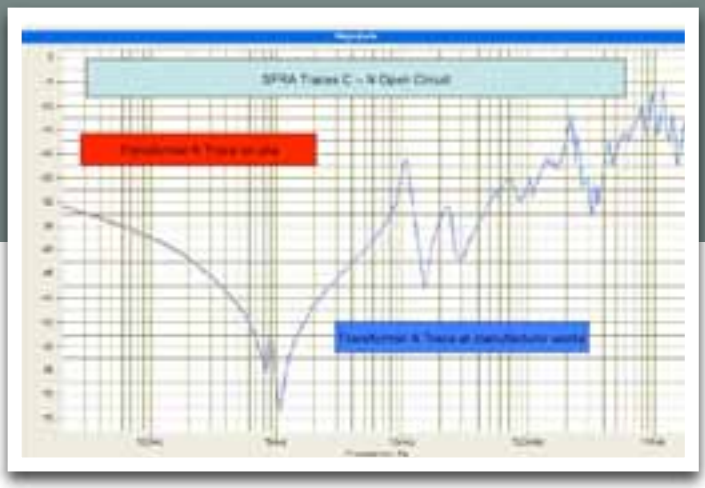
## IMPEDANCE TESTING/ LEAKAGE REACTANCE

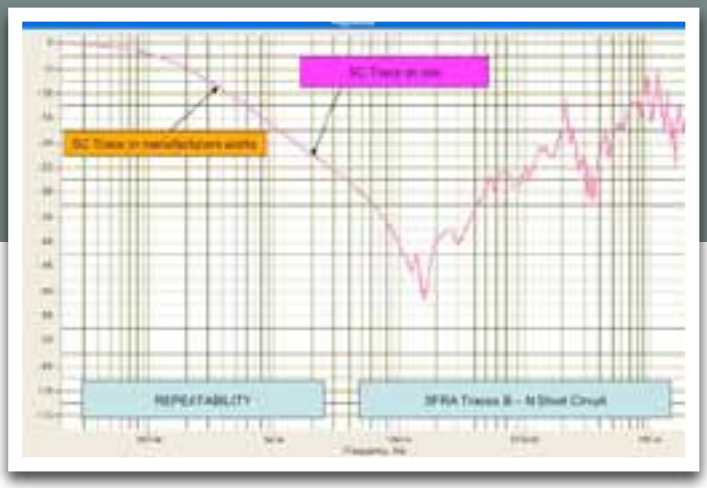
This test is performed during commissioning tests, preventive maintenance tests and after fault trips. The initial "benchmark"




***The above results show the results of a magnetising current test performed during commissioning tests on a 45 MVA 88kV transformer and those measured after a fault trip had occurred. The result after de-tanking the unit showed an inter-turn fault had occurred.***




test is performed by short circuiting the LV winding of the transformer and applying a 3 phase, 380 volts, voltage to the HV winding. The phase currents and voltages are measured and by calculation comparison is made to the nameplate % impedance. The result of the benchmark test compared to the nameplate value should be within 2 to 3 %. This test can be used to locate short circuits within the windings, core damage and winding movement. It also provides information for mechanical condition assessment of the transformer. Single phase testing can also be done and by formula converted to a 3-phase equivalent.

## SWEPT FREQUENCY RESPONSE ANALYSIS

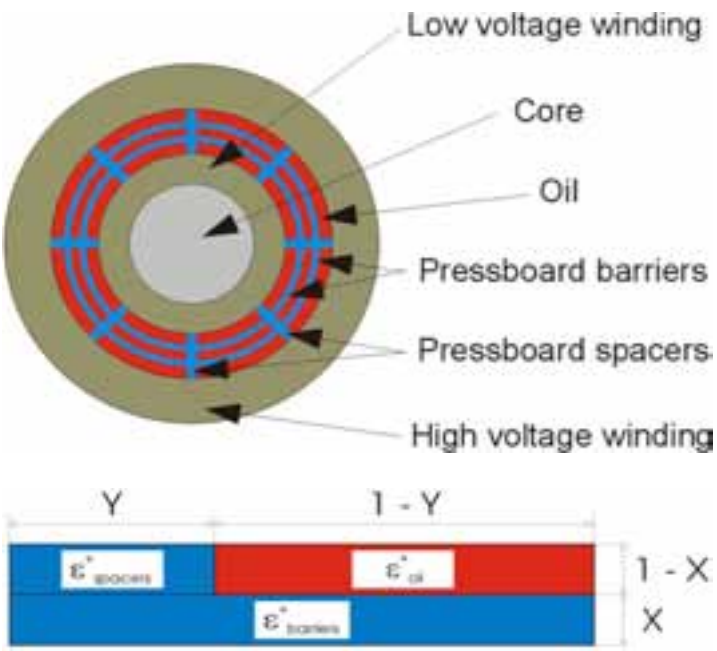
This test is performed during commissioning tests, preventive maintenance tests and after fault trips. This test is extremely important and useful where transformers have been transported from one site to another or transported from manufacturers in various parts of the globe to sites in South Africa. The test will indicate any deformation, movement or displacement in the windings and core that may be caused by dropping or severely bumping the transformer. It would be advantageous for the user to insist that SFRA tests are performed on the transformer prior to leaving the factory for comparison when the transformer is finally installed and commissioned. Other faults such as faulty core grounds, partial winding collapse, hoop buckling, broken or loosened clamping structures, shorted and open circuited turns could be identified. The test provides information for assessing the mechanical condition of the transformer. The correlation and difference analysis is used to aid in frequency response analysis diagnosis. Repeatability of the test is critical in assessing transformers that have been transported, factory test against test after transportation.

## TIME AND FREQUENCY DOMAIN SPECTROSCOPY

These techniques are used to evaluate the condition of oil impregnated transformer and bushing insulation systems. Frequency domain spectroscopy only will be discussed in this article. In this test the frequency response is analysed. Tan delta measurement is done in a frequency range from 1 KHz down to 0.001 Hz, due to the ageing process the insulating materials will change in capacitance and tan delta value. Capacitance and tan delta will both increase for a decrease in frequency. By utilising a range of frequency a bigger picture of the insulation system can be made for example separation of the solid and liquid affects. Technique would be extremely useful and time saving during the vapour phase drying of transformers after assembly of the active part.

## X-Y MODEL OF TRANSFORMER INSULATION

This gives the geometric capacitance of the insulation. To enable the dielectric frequency response to be modelled the geometric design and layout as well as the material properties (conductivity and permittivity) needs to be known. Connection of the test equipment to the DUT (device under test) is the same as that for tan delta and capacitance testing. The modes used are GST (grounded specimen test) and UST




***X = Relative amount of barriers in the main duct***
***Y = Relative amount of spacers on the circumference***

# Power Transformer Field Testing

*continues from page 37*

(ungrounded specimen test). For moisture determination it is preferable to use the UST mode as the only current included in the measurement will be that between the HV and LV winding. In the GST mode all leakage currents will be incorporated into the result.

The test is used to assess the condition of the insulation system, being able to separate effects in different insulating mediums such as insulating oil and cellulose insulation. It is an excellent tool for determining the moisture content in the paper insulation and insulation ageing.

By "benchmarking" at commissioning the test results can be used in a maintenance program to determine deterioration and ageing in the oil and insulation. Early detection can allow action to be taken in the form of drying the insulation before critical DP levels are reached or bubble formation due to moisture could lead to ultimate failure.



Equipment suppliers have software to do the necessary modelling and calculations and provide moisture content in cellulose values. The use of moisture in oil equilibrium charts (Piper, Griffin, Oommen etc.) for estimation of water in cellulose insulation is not reliable or accurate at low temperatures. Should oil samples not be correctly sampled or containers contaminated a further error in moisture in oil will result (Karl Fisher titration). Insulating oil solubility will also affect moisture determination accuracy.

## SUMMARY

Consideration must be taken for new improved design techniques, materials such as core steel, thermally upgraded Kraft paper but ultimately insulation thickness, oil volume and internal clearance distances are the critical factors. New transformers will need closer condition monitoring systems and preventive maintenance to provide the same lifespan as their predecessors.

To ensure that the transformer is in serviceable order after installation comprehensive commissioning tests need to be completed on the unit. Once the unit is energised condition-monitoring process can follow with preventive maintenance tests being done routinely as prescribed by the users' maintenance program.

The test results need to be comprehensive and should be kept in the transformer file for later comparison to preventive maintenance tests or tests after a fault has occurred. Test thumbprints at commissioning are vital for future condition assessments.

New test technologies utilising signal acquisition techniques have made diagnostics of transformer insulation systems easier to trend and monitor when maintenance test programs are used. SFRA and FDS amongst these. Comprehensive testing duration of a transformer during maintenance has been greatly reduced and generally can be completed within 4 to 5 hours.

By adding an additional few operating years to the expected end of life of the transformer will afford the utility or asset owner huge cost savings. wn

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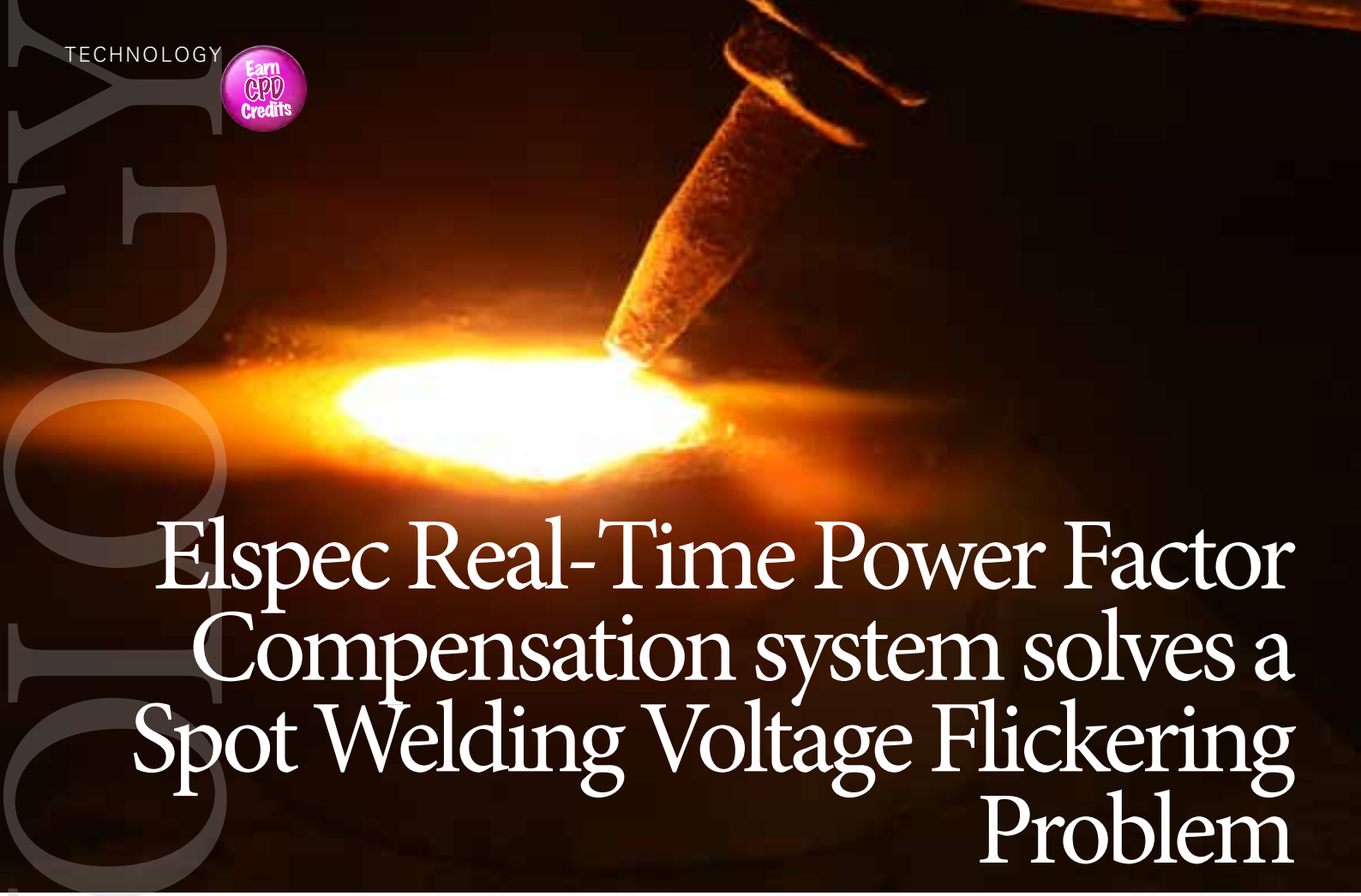

# Elspec Real-Time Power Factor Compensation system solves a Spot Welding Voltage Flickering Problem

The Husqvarna group is the world's leader in outdoor power products and utilizes sophistically multi-spot welding as an integrated process of chainsaw bar manufacturing.

**BY** | POL NISENBLAT | C.T.O. | ELSPEC AUSTRALIA

The welding process is imminent as high quality welding assures a longer bar life. Husqvarna Norge AS has installed spot welder from the Swiss manufacturer "Schlatter". The 5000A, 400V, 50Hz balanced "Schlatter" spot welder has a welding duration of 60ms with 8 to 10 seconds between welding. The spot welder's Transformer is 2000 kVA.

## LOAD FLUCTUATION & VOLTAGE FLICKERING

A short while after the Schlatter's spot welder installation, residential energy consumers connected to the same transformer in the substation as Husqvarna, complained about continuous significant blinks in their illumination.

Spot welding loads fluctuate extremely rapidly and consume large amounts of power. Due to high current changes caused by the near-instantaneous reactive energy consumption, large voltage drops are produced. These sags reduce weld quality and decrease welding productivity.

Additionally, these loads often create a high incidence of voltage flickering, which frequently exceeds recommended local and international regulations and standards.

In order to prevent residential energy consumer's flickering complaints, the local utility addressed the problem as they connected the Husqvarna factory as a sole consumer to a 15MVA transformer.

While voltage flickering problem had been improved for a short while, due to rising energy demand, the utility instructed the factory to eliminate the voltage flickering or they will be disconnected from the transformer.

## SOLUTION

Standing before production shutdown, Husqvarna engaged Vold Engineering AS, Elspec's certified agent, to perform measurements in order to find a solution for the problem.

As Elspec was the only supplier of capacity device, which could compensate the inductive current quick enough during the spot welding period, Vold Engineering

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# Elspec Real-Time Power Factor Compensation system solves a Spot Welding Voltage Flickering Problem

*continues from page 40*

and Elspec had specifically tailored a unique Real-Time Power Factor Compensation Equalizer system equipped with Pre-signal technology.

Based on repeated patterns of welding cycles and batches of a welder working under repetitive conditions, the shape of each spot welding cycle was studied by the Equalizer system which allowed it to connect capacitors steps according to preset previous batch operation without actual measurement of the actual reactive demand. The operation was triggered by an external signal, which provided the upcoming welding process.

By installing the Real-time Equalizer system, current variations have been substantially reduced by 50% from approx. 3900A RMS (5500A Peak) to 1800A RMS (2500A Peak) while active energy remains constant approx. 275kW per phase (825kW total) (Figure 4 and 5).

The reactive energy was compensated and reduced from approx. 750kVAr to almost zero (Figure 5).

## CYCLE BY CYCLE RMS TRENDS

Voltage drops were mitigated by reducing the sags from approx. 45V to 10V for connection/disconnection cycles only and the others to almost zero (Figure 5 and 6).

## CYCLE BY CYCLE TREND VIEW

Flickering Pst values were dropped from approx. 3.0 to 0.5, allowing production to continue with optimal power quality conditions and with compliance with regulations.

Voltage flickering reduction is possible on either single or multiple welding operations by utilizing the real-time power quality enactment system with pre-signal technology. wn

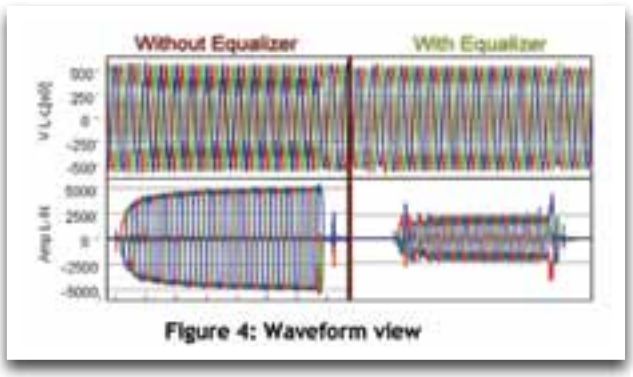


Figure 4: Waveform view

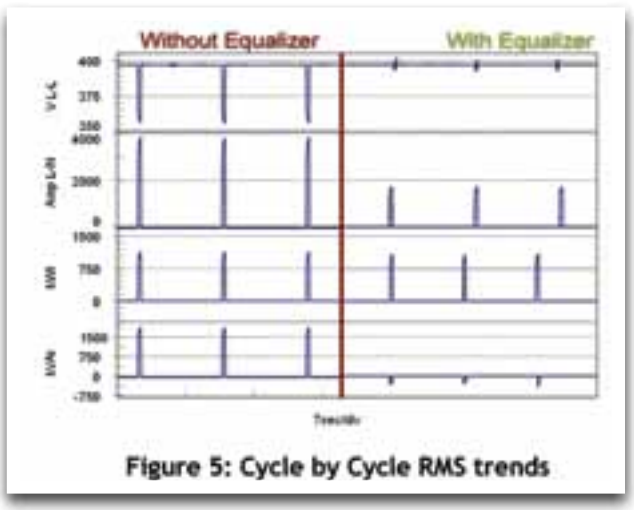


Figure 5: Cycle by Cycle RMS trends

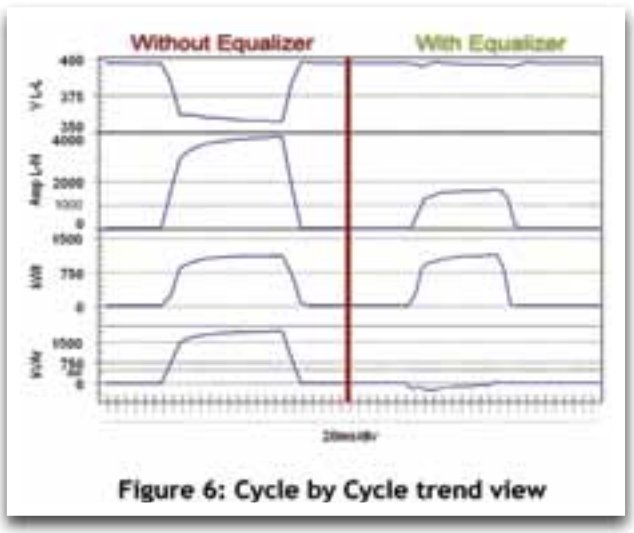


Figure 6: Cycle by Cycle trend view

## MAJOR BENEFITS:

- Improved Welding quality and reduced scrap/rework by stabilizing current at welder tips.
- Increased process output
- Reduced voltage flickering
- Enhanced service utilization for the facility (better utilization of the existing power infrastructure)
- Reduced maintenance costs
- Network has been stabilized

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# LEADERSHIP IN THE FIRE INDUSTRY

The Fire Detection Installers Association (FDIA) is the South African authority representing the fire detection and gaseous suppression industries, providing technical advice, training and third party inspections and recommending contractors and suppliers. These services are available to end users, architects, consultants, specifiers and contractors.

The FDIA was formed in June 1999 and has now been in existence for 13 years. The Gas Extinguishing Division (GED) was incorporated into the FDIA in August 2004.

The Association provides representation and leadership for the fire detection and gaseous extinguishing system(s?) industries. Both the FDIA & GED were established to uplift quality and professionalism within the industry through training and by informing its members, consulting engineers and specifiers of changes and technologies, both in and affecting, the industry, thereby providing an overall service to the relevant South African professions and industries.

The FDIA is a voluntary association administered by a committee elected by its members from within the fire detection and gaseous extinguishing industries.

Its thirteen years of existence have seen an organisation established by four individuals grow in status to become the authority in South Africa for fire detection and gas suppression, with 137 member companies for supply and installation services from all corners of the Republic. All member companies are issued a full set of South African standards, together with a sample log book and documentation for use in their business operations.

Grading of contractors was introduced to assist consulting engineers and end users to match the size of project against the correct range of contractors. Today many tenders are issued specifying that work can only be conducted by FDIA members, with municipalities and fire departments insisting that any work undertaken on fire detection systems or gaseous installations is conducted exclusively by FDIA members.

In adition, the FDIA is the driving force bringing new, and keeping in place existing, industry standards alongside SABS standards. The FDIA was responsible for instigating training courses for fire detection and gaseous suppression, which are now run by Fire Systems Training.

A further move was the introduction of third party inspections of fire detection and gaseous suppression systems to check the quality of workmanship offered by its members. This is now a compulsory requirement for membership, its function being conducted by the FSIB.

The FDIA financed cable testing and brought about sweeping changes to the types of cable being used for fire alarm systems in the country, these now being the accepted norm.

To uplift the quality of technicians, the FDIA has formed a strong bond with SAQCC Fire for the registration of technicians. The Association has also communicated with the Department of Labour and encouraged it to instruct SAQCC Fire to require compulsory registration of technicians in the country that is to be implemented in August 2012.

Issue of the compulsory technician registration requires a full range of training to be established, leading to measurement of competency for all levels of technicians and providing a career path for technicians in the industry.

The continued drive by the FDIA for improvement of industry standards aids all South Africans by ensuring a safe working environment, as well as safeplaces of entertainment and accommodation, that are guarded against the threat of fire.

Commenting on the state of the industry in South Africa, Keith Norgate, liaison officer of the FDIA, says, "There is still a long way to go in South Africa in the policing of technicians and companies to produce quality workmanship and finished product. However, the systems and procedures are in place to achieve this."

Without a relevant government authority, the FDIA has become the force in the South African fire industry for technical support and information.

For further information and member contractor listing, please consult the FDIA website at www.fdia.co. The FDIA has forged strong working relationships with other industry Associations, such as SAQCC Fire and ASIB, as well as fire departments, municipalities and end user organisations. wn

# can you spot the difference?


**What the FDIA can do for you?**

The FDIA is a listing organisation for fire detection and gas extinguishing contractors and suppliers.
We offer technical assistance and advice to the fire detection and gaseous suppression industries.
We proudly support technical training, as well as third party inspections.
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General enquires
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*visit us at*
***www.fdia.co.za***

FDIA
Fire Detection Installers Association

68 12th Avenue Edenvale Gauteng South Africa

# On the use of decimal numbers with negative placeholders

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

The numeration system in common use today is based on the Hindu-Arabic decimal model which uses a place value to imply the power of ten of which the digit is the multiplier.

This system made necessary for the first time a value of zero to be a placeholder for a nul use of that particular power of ten. Thus the number 1089 refers to a quantity having the value of one thousand zero hundreds eight tens and nine units. This may be written in polynomial form as:

***$x^3+8x+9$ where $x = 10$, the term in $x^2$ being absent as its coefficient is zero.***

Clearly ***x*** may take on other values for numbers using other bases.

In considering the polynomial form of the number, however, it occurred to me that some use might be found for an expression that uses negative values for the coefficients. As an example the number 89 may be represented by the polynomial ***$x^2 - x - 1$ which is equivalent to 100-10-1.*** In normal placeholder notation this could be written as ***1 -1 -1***. Equally 1089 could be written as ***11-1-1***.

A case where use was made of this occurred in the solution of a polynomial equation as follows: ***$x^6+3x^5+3x^4-4x^3-12x^2-12x-4=0$***

Ideally this sixth degree polynomial should factorise into three quadratic terms so it seemed that one way to do this would be to let ***x =10*** and then to factorise the resulting number. The number turns out to be 1324676, which in a few minutes with the calculator proved to be divisible by 89 with a quotient of 14884, a perfect square = $122^2$.

Converting these three digit numbers (and notice that negative coefficients are necessary to do this) back by using ***x=10*** gave me the three factors of the polynomial, namely:

***$89 \bullet 122^2$ corresponding to $(x^2-x-1)(x^2+2x+2)^2$***

Solving the quadratics immediately gave me the results:

$$x = \frac{1 \pm \sqrt{5}}{2}; -1 \pm i$$

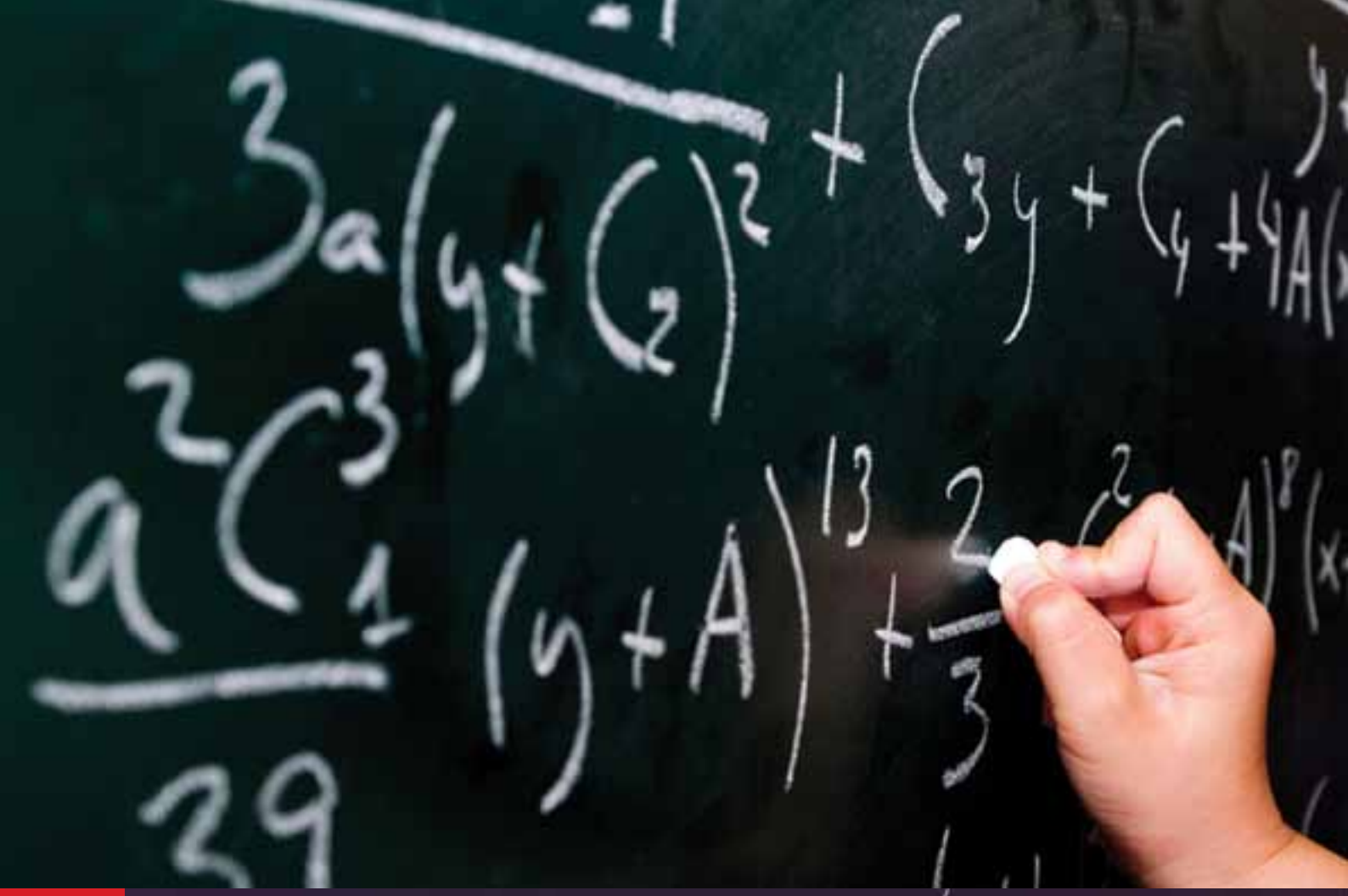
It obviously works where the decimal number factorises into three digit decimal numbers and these sometimes entail using negative decimal coefficients. Even then there may be a number of choices so some discretion is required to find the right ones. The following is an example where the factorisation was not immediately obvious.

***$4x^4-8x^3-13x^2-10x+22 = 0$***

Putting ***x = 10*** gives a value of 30622 which factors into (122) (251) and then putting these numbers back into quadratics gives ***$(x^2+2x+2)(2x^2+5x+1)= 0$*** which obviously cannot be right since there are no negative coefficients and the coefficient of ***$x^4$*** is 2 and not 4. However all is not lost as a little searching found that 251 can be expressed as ***$4x^2-16x+11 = (400-160+11)$*** or ***4 16 11*** so we now have the quartic equation broken down to two quadratics multiplying back correctly as ***$(x^2+2x+2)(4x^2-16x+11)= 0$***, which is now solvable by conventional means.

Notice also that this example used placeholder values that exceeded the number base of 10. These could be named "excessive placeholders" perhaps.

Clearly if the polynomial converts to a prime number you are out of luck! wn



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# ENGINEERING COUNCIL OF SOUTH AFRICA

Voluntary Associations (VAs) in engineering disciplines are a long-standing part of the engineering profession in South Africa, many having already celebrated their centenary. In the 1960s the profession was united in recognising the need to protect the public in relation to engineering activity, a function they could not do as voluntary bodies. The profession approached government to seek legislative approval for the registration and regulation of engineering professionals.

The resulting Professional Engineers' Act (No 81 of 1968) founded the South African Council for Professional Engineers (SACPE) in 1969. Under this Act only professional engineers were registered and regulated.

Deliberation in the 1970s on other engineering roles developed an understanding of engineering technicians and technologists, captured in the Goode Report of 1978. The first Act was amended in 1979 to accommodate the establishment of Boards of Control for the registration of Engineering Technicians (1983), Technologists (Engineering) in (1985), and Certificated Engineers in (1987).

The Engineering Professions of South Africa Act (No 114 of 1990) replaced the first Act, incorporating these additional categories of registration directly in the Act, as opposed to using the device of Boards of Control. This Act was expanded to provide for specified categories such as Lift Inspectors and Lifting Machinery Inspectors.

During the period from 1994 to 2000, the engineering profession, along with other professions, was under review nationally. This review produced a Policy Document in 1999 reinforcing the case for professional regulation. The key principle was the competency of practitioners being essential to ensuring public health and safety. Four existing professions (engineering, architecture, quantity surveying and property valuation) were the subject of the review. In the process, two new professional bodies were recognised, namely project and construction management, and landscape architecture. These deliberations culminated in the establishment of the Council for the Built Environment (CBE), as a form of umbrella for the six professions, despite the lack of unanimous acceptance and precedent.

A third Act, the Engineering Profession Act (No 46 of 2000) (EPA) established the Engineering Council of South Africa (ECSA) in its present form. The Act establishes four professional categories of registration: Professional Engineers, Professional Engineering Technologists, Professional Certificated Engineers, and Professional Engineering Technicians, with a candidate category corresponding to each. Additionally, ECSA is empowered to establish specified categories of registration, a facility it has used to certify

the competence and regulate practitioners for specific health and safety functions, for example lift inspectors.

ECSA and its predecessor thus have a forty-year track record in regulating the profession, with a growing scope and numbers of registrants. Currently the number of professional, candidate and specified category registrations with ECSA exceeds 39 000.

## MANDATE

ECSA's mandate under the EPA has two legs: statutory functions that it must perform, and empowerment to perform a range of functions in the public interest. Mandatory functions cover the life cycle of an engineering professional: accreditation of educational programmes, registration and the regulation of practice. The last involves the observance of a code of conduct, acting on complaints, investigation and tribunal system for dealing with misconduct, and periodic renewal of registration based on continuing professional development. To support these functions, ECSA must set standards of competence and education, and may conduct examinations, recognise VAs and enter international recognition agreements.

The EPA contains a provision designed to protect the public by requiring that engineering work identified as requiring the competence of a registered person for effective, safe and environmentally sound outcomes must be performed by a person registered in an appropriate category. ECSA has performed its function of identifying such work for each of its professional categories (the work of specified categories is defined in their founding documents). The CBE (Council for the Built Environment) is, however, required to set overall policy on identification of work for the six professions under its umbrella, consult the Competition Commission and promulgate the identified work. This cumbersome process has not been completed and the intention of the Act to have compulsory registration for responsible performance of identified work is, five years on, not a reality.

ECSA's discretionary functions under the EPA include advising government and other bodies, undertaking or promoting research, taking any steps to protect the public, improving standards of services, promoting environmental protection, and protecting health and safety. The ECSA has a number of strategic initiatives related to the engineering skills pipeline.

## GOVERNANCE AND OPERATIONS

ECSA is governed by a Council of 50 members of whom 30 are registered professionals representing disciplines and categories within the engineering profession, 10 are nominees of the state and 10 are public representatives. This composition arose from a principle in the 1999 Policy Document: regulation of the profession should rely primarily on professional expertise, but should be informed by the public interest.

Most of ECSA's functions require peer judgement in decision-making. ECSA therefore has a range of committees with specific decision-making powers, for example registration, accreditation and investigation committees. Such committees are constituted by nominations from stakeholder bodies –VAs and higher education as appropriate. The committee system relies on more than 300 volunteers from the engineering profession. These volunteers generously give of their expertise and time, and work tirelessly for the good of the profession.

The VAs are the seat of expertise in engineering disciplines and specialised practice areas. ECSA consequently works very closely with them. The EPA provides a recognition mechanism for VAs; currently 44 VAs are recognised.

The day-to-day running of the Council is handled by a staff complement of around 60 people headed by a Chief Executive Officer. The executive and administrative functions of ECSA on the one hand support the expert peer-review committees that make decisions relating to standards, accreditation, registration, professional conduct and international recognition. On the other hand, a wide range of expertise is available to support the executive function in volunteer committees on career information, communications, marketing, corporate governance, finance and legal matters.

## ROLE OF REGISTRATION

Engineering is a profession with a core competency of solving problems based on engineering sciences. Engineering solutions are necessary for the delivery of infrastructure, goods and services. Because engineering involves exploiting and controlling natural forces and complex systems and processes, the attainment of solutions is accompanied by risks. Mitigation of these risks requires competent and accountable engineering professionals. The registration system has been established by law to ensure this competence and accountability.

Registration provides public recognition that the registered person has, through education, training and experience, demonstrated competence at an established level. It signals to the public, employers and peers that the person has not only demonstrated competency, but is bound by a Code of Conduct, is accountable for professional conduct and is committed to maintaining his or her competency.

Titles attached to categories of registration and their abbreviations, for example Professional Engineer (Pr Eng), are legally protected, and it is therefore a criminal offence for an unregistered person to use such a title.

# ENGINEERING COUNCIL OF SOUTH AFRICA Profiles

## CHRIS CAMPBELL
## ECSA PRESIDENT

Christopher (Chris) James Campbell is the President of the Engineering Council of South Africa (ECSA), a position he has held since August 2009. Chris holds a BSc Civil Engineering degree from Florida Agricultural and Mechanical University (FAMU) USA, and a National Higher Diploma in Civil Engineering. He has also completed various recognised Management diplomas including both an Executive Development Programme as well as the Board Leadership Programme. He was until recently, a director at a leading Consulting Engineering firm responsible for its railway engineering services and has worked with various other firms in senior positions such as Transnet Capital Projects, Transnet Freight Rail, Bombela Operating Company, GMH, SRK and Arup on projects ranging from as small as a few hundred thousands of rand to multi-billions of rands.

Chris has in the past and currently still serves on numerous national and international student and professional bodies. These include roles such as, President of the International Students' Society at FAMU, Gauteng Branch Chairman of the South African Black Technical and Allied Careers Organisation (SABTACO), Chairman of the Railway and Harbour Division of the South African Institution of Civil Engineering (SAICE), Vice-President of SAICE, Vice President of the Engineering Council of South Africa (ECSA) and now President of ECSA. He also serves as a Vice President and Chair of the World Federation of Engineering Organisation's, Committee on Engineering Capacity Building since September 2011.

Chris is no stranger to the executive processes of professional organisations and commercially driven companies and currently serves as a General Manager in the Aveng Manufacturing, Infraset Business unit.

He is of the belief that diversity and a sense of patriotism are among the powerful forces in South Africa which should be embraced and leveraged, both in business and in professional organisations, to ensure future sustainability of our beloved Country.

## THOKOZANI MAJOZI
## ECSA VICE-PRESIDENT

Professor Thokozani Majozi won the S2A3 British Association Medal for Engineering – the first black person to achieve this prestigious title since the inception of the association in 1932. He was recently awarded the National Science and Technology Forum (NSTF) Category B Award (2011) for individual contribution to research over the last 5 to 10 years.

As a full-time professor of chemical engineering at the University of Pretoria (UP) and associate professor at the University of Pannonia (Hungary), Thokozani brings a wealth of academic experience to ECSA which belies his age.

Indeed, this experience has already been tapped into as he is the current chairman of both ECSA's Education Committee and the Chemical Professional Advisory Committee. He holds an MSc Eng (Chemical) from the University of Natal (later changed to the University of KwaZulu-Natal) and a PhD (Process Integration) from the University of Manchester Institute of Science and Technology, UK.

At the age of 40 he has seen two major innovations in batch process integration being adopted by the chemical industry. From junior process engineer at Unilever in 1994 to full professor at UP in 2008, Thokozani's path to recognition has been meteoric to say the least. As a practising engineer, he also worked for Dow AgroSciences and Sasol Technology. His list of academic and professional publications, including an international textbook on Batch Chemical Process Integration published by Springer in 2009, would fill a small library, but suffice to say that he is widely respected as both a theoretical and practical engineer.

In June 2010 Professor Majozi was awarded the South African Institution of Chemical Engineers (SAIChE)'s prestigious Bill Neal-May Gold Medal Award which is granted for outstanding achievement in chemical engineering. wn

# ENGINEERING COUNCIL OF SOUTH AFRICA

ECSA

*continues from pg 49*

As indicated above, the intent of the EPA is to require registration for the responsible performance of identified functions. There are, in addition, a number of instances in which registration in particular categories is required by other legislation, for example the National Building Regulations, the Pressurised Equipment Regulations and the Water Act.

Engineering is a global activity, with services and technology being exchanged across national boundaries. The standards of engineering education and professional competence are therefore benchmarked internationally. At the educational level, ECSA is a signatory to the Washington, Sydney and Dublin Accords (respectively for the education of engineers, engineering technologists and engineering technicians). These agreements, in addition to periodically verifying ECSA's standards and accreditation processes, also provide for mutual recognition of graduates among the signatories.

At the professional registration level, the competency standards recently adopted by the ECSA to express the registration requirements in outcomes form have been benchmarked against those of the Engineers Mobility Forum (EMF) and the Engineering Technologist Mobility Forum (ETMF).

Registration with ECSA and membership of a VA such as SAICE are complementary. The VA promotes the interests of the discipline and its members and provides services such as continuing professional development. Different grades of membership – for example student, member and fellow – recognise the member's career progression.

ECSA provides the legal regulation of professional practice to ensure that safe, effective and environmentally sound solutions are provided and that risks are managed. The nexus between the VA and ECSA is a corps of professionals, benefiting from the VA activities and professionally recognised through registration. WN

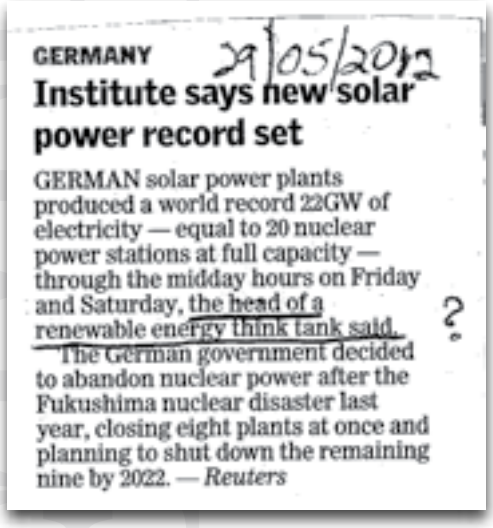
# You said...

Dear Minx

I address this note to you rather than to one of the Technical Editors, because it's a small little exercise;

If you think one of the younger Engineers in your ken would like to read the 'attached' *(see below)* clipping, do an assessment, and calculate how many Wind Towers/ PV farms Germany has in operation, please pass it on. I would be interested to hear if anyone else comes to the same conclusion that I did. Thanks for finding space to print my letter re - Hessequa Solar Powered Scheme. I look forward to some debate there.

Travy Brick
travyb@8tamail.com



GERMANY 29/05/2012

**Institute says new solar power record set**

GERMAN solar power plants produced a world record 22GW of electricity — equal to 20 nuclear power stations at full capacity — through the midday hours on Friday and Saturday, the head of a renewable energy think tank said.

The German government decided to abandon nuclear power after the Fukushima nuclear disaster last year, closing eight plants at once and planning to shut down the remaining nine by 2022. — *Reuters*

*ED - Thank you for your letter - I'm sure you will get some feedback. I've printed your email address and contact number so our members can contact you directly.*
*Please let me know your findings.*

Dear Editor

Congratulations on your appointment as Managing Editor of **watt**now and also to Mr Mike Cary the new SAIEE president for his interesting recent article (April 2012) regarding Energy Efficiency and Renewable Energy Resources - issues that driving as emergency in South Africa.

Given the fact that in South Africa presently the amount of generation capacity available close to the demand for power that makes the introduction of energy efficient initiatives an important imperative. Surely it's differs than in the late 1990s where generation shortage was the result of lack of timeous investment in generation capacity. With the capacity increase means between now, the capacity expansions programme Eskom projects will be able to offer an opportunities for the utilities of diversity supply double from 40.000MW. To minimise the risque of power outages over the time and to keep full and stand the power system tight on the National electricity transmission grid (along supply or demand side options), it is important of Demands Side Management (DSM) to implement and intervene with structure of installing energy efficiency as a standard practice in Residential, Commercial and Industrial. Furthermore of preventing energy efficiency and cost of energy prices a good structure measure in the power sector reform in South Africa (Countrywide):

- The renewable energy sources needs to be selected and designed to meet the specific needs for the expected future load duration curve of the interconnected system for base load, intermediate, peak load and reserve duties capable of performing restricted duty at lower cost to match the growth of the need for peaking and reserve plant.

- Each region of distribution and Sub-region (Municipality) required the right balance of below-cost; it means restructuring and rationalization to improve efficiencies within energy intensity calculated on the basis of energy demand and projection to capture energy.

Increasing energy prices and rapid changes in energy market represent a burden not only on the economies, macro and micro levels, but also on the daily life of the populations, particularly those living in scattered remove areas.

In conclusion, load and energy reduction (energy efficiency) can be achieved if customers change behaviour about the need to use electricity responsibly and sparingly. Also by altering the interventions of Demand Side Management (DSM) installing devices and Smart meters.

In concern, used stations older than 25 years, we need to assure good service maintenance. Not allowing stations to go below reserve storage of 15%. When these stations are under maintenance other stations could assist and maintain the demand during long maintenance periods as many stations will be needing maintenance in the future in SA. Currently stations have a reserve capacity of 10%.

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

These matters of increase price need necessary for more precision to be analysis in the qualitative, storylines and modify in the qualitative assumptions in the study model based on input from the regional and the need by on study region and sub-region (Municipality) to accommodate developments in another region that affected global (countrywide) development prices.

Regards,
LURAKWA JULES
SAIEE

*ED - Thank you for your letter, it is greatly appreciated.*

---

Hi Minx
OOOOOPS!! I missed out an important historical event.

Roy Walter, also an 'old timer' who worked with me at the JHB Electricity Department (and visits me each Wednesday for 'Coffee' whilst his wife goes to a Ladies Bible Study Group) when reading my article (May issue) on the Rand Show pointed out that the whole caboodle moved to The University Showground's (with the Tower of Light) before finally coming in to land at The Rand Mines Showground, south of the City. I apologise for the omission.

I would also like to take this opportunity of congratulating you Minx, on your FANTASTIC presentation of my humble effort, you are a Star !!

Kind Regards
John Davies."

P.S. I loved the way you fished out my quotation by Isaac Watts 'Time like an ever rolling stream ..." (coming from his hymn 'O God our help in ages past') and made it a heading. It is very appropriate for all the reminiscences from us 'Old Timers' .

*ED - Thank you for your letter, Mr Davies, it is always good to receive mail from you - and thank you for the beautiful compliment! I do enjoy your 'reminiscing' articles - it is really fascinating to learn how things were 'back in the day'!*
*Keep your articles rolling in - I'm looking forward to the next one.*

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| 11-12 | Understanding Switchgears | Viv Cohen | 2 |

## JOHANNESBURG

| DATE | COURSE | PRESENTER | CPD |
|---|---|---|---|
| **JULY** | | | |
| 18-19 | Photovoltaic Solar Systems | Attilio Dalvit | 2 |
| 11-12 | Electric Arc Flash Safety | Zaheer Jooma | 1 |
| **AUGUST** | | | |
| 14-15 | Presentation Skills For Engineers | Michelle Haffner | 2 |
| 22-23 | LV Variable Frequency Controls | Chris Conroy | 2 |
| **SEPTEMBER** | | | |
| 11-12 | Electromagnetism – Transformers | Viv Cohen | 2 |
| 18-19 | Finance Essentials For Engineers | Tony Lydall | 2 |
| 26-27 | Microsoft Excel | Jade Scott | 2 |
| **OCTOBER** | | | |
| 18 | Electric Power Cable Tutorial | Dick Hardie | 1 |

For more information or to book your space, contact
ROBERTO BENITES | **T** 011 487 9042 |**E** roberto@saiee.org.za

SAIEE

Left: CEO, Ernest Ngubo - Pr Eng SMSAIEE  Right: Managing Director, TC Madikane - Pr Eng, FSAIEE, FSAAE

## Company Background

Igoda Projects, was established in 1999 and is an integrated engineering consulting firm providing electrical, electronics engineering services as well as project management.

The company is 100% black owned and managed. Both shareholders and directors are Professional Engineers. Igoda Projects is a Level 2 BBBEE generic contributor.

## Our People

We are a people and results-oriented business that matches the right people to the right project for best outcomes. We have a staff compliment of 70, which comprise of Professional Engineers, Professional Engineering Technologists, Professional Engineering Technicians, Technical Support, HR and Finance staff.

## Our Services

- Electrical Engineering
- Electronics Engineering
- Energy Management
- Project Management

## Corporate Social Responsibility

High on our Social Responsibility initiatives, is our support and sponsorship of engineering students at Mangosuthu University of Technology (MUT) and Durban University of Technology (DUT).

Specifically, over the past four years, we have provided over R500 000 towards educational grants and in-service programmes.

## Key Clients

- Department of Public Works
- Department of Health
- Independent Development Trust (IDT)
- Eskom
- Ethekwini Municipality
- Umngeni Water
- ABSA
- Tiger Brands

## Our Track Record

We have succesfully delivered several projects. Some of the major projects includes Durban International Convention Centre, Moses Mabhida Stadium, Sibaya and Suncoast Casinos to mention a few.

## Corporate Membership

- Consulting Engineering of South Africa (CESA)
- Green Buildings Council of South Africa (GBCSA)
- South African Association of Energy Services Companies (SAAEs)
- Illumination Engineering Society of South Africa (IESSA)
- Durban Chamber of Commerce

## Our Offices

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IGODA
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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.

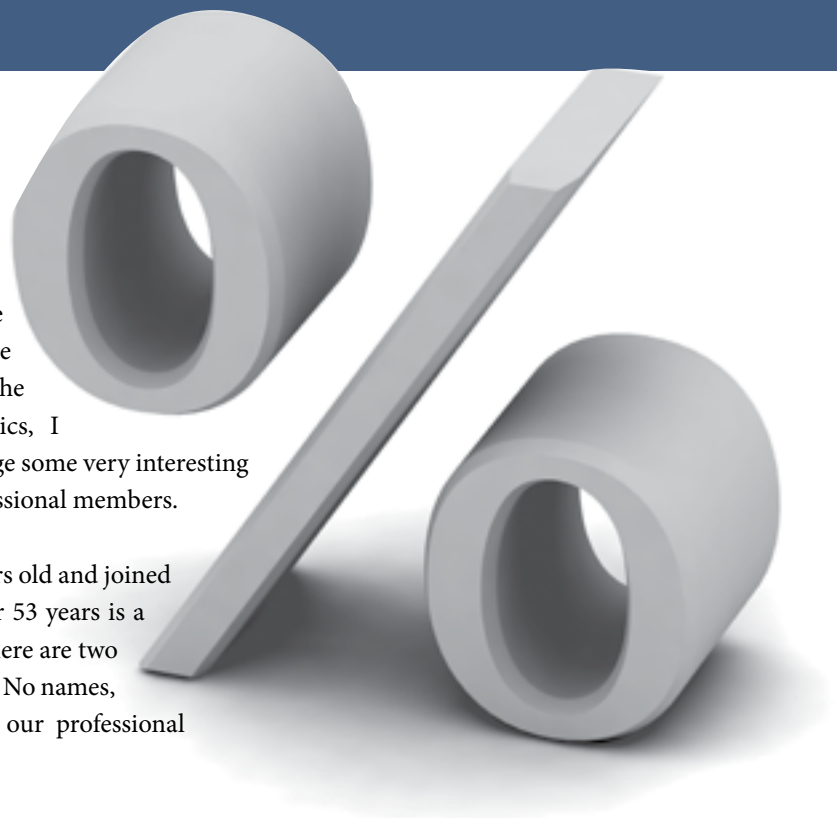
The mentor could recommend to the mentee what course of action to take without being too prescriptive while the final decision and the consequences remain with the mentee.

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.

**Prospective SAIEE Mentors**

*If you feel you that you have the time and interest to help mentees, please contact Sue Moseley on 011 487 9050 or suem@saiee.org.za. In addition you gain CPD credits for when you are required to re-register.* wn



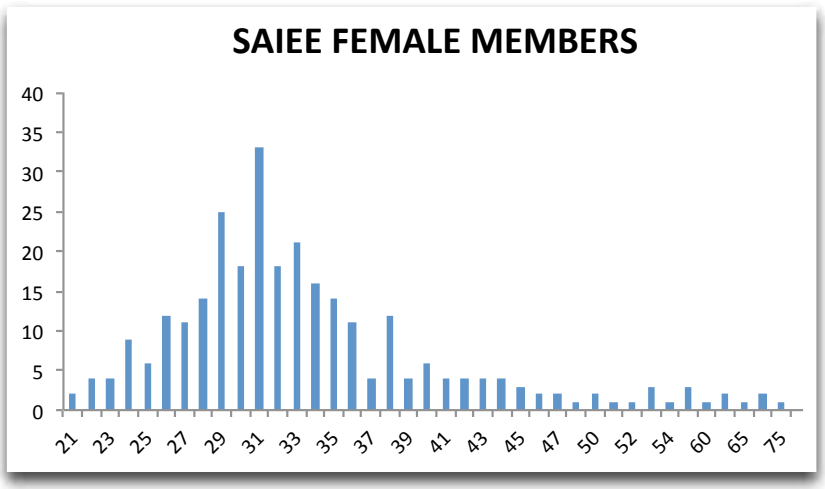
It is said to be improper to enquire about a woman's age but in the context of boasting about the Institute's membership statistics, I would think that it is safe into divulge some very interesting information about our female professional members.

Our eldest female member is 75 years old and joined the Institute in 1959. A member for 53 years is a tremendous achievement. In fact there are two members in the 66 to 75 age bracket. No names, no pack drill – remember this is our professional ladies I am talking about.

At the other end of the spectrum two members are 21 years old and there are more than 150 members between ages 30 and 40.

Guess what? More than 72% of our female members are 35 years of age and younger! - Medical aid schemes would give anything for this statistic I am sure.

The graph hereunder is a picture of the statistic and the new wave of women engineers starting to emerge in blue. This is a very satisfying trend that I predict to be exponential from now on. wn




**COUNT PER AGE GROUP**

# SAIEE VITAL STATISTICS

**BY** | STAN BRIDGENS | PR. ENG | FSAIEE | SAIEE BUSINESS DIRECTOR

***For more information on how to become a member, visit www.saiee.org.za or contact Ansie or Tracey on 011 487 3003.***

A coastal engineering wonder was born when two men put their heads together for the good of their coastline – and coastlines around the world. It all began in 1963, when a storm devastated the Eastern Cape coast of South Africa. Anxious to protect their harbour, two East London engineers developed a series of branching concrete blocks called dolosse that, when piled together, could absorb the ocean's power. The simple design was so successful that the men decided not to patent it, which is why these unique blocks can be found in their millions in over 100 countries across the globe.

**Those engineers knew something we at PPS have long believed – that the key to success lies in sharing it. That's why the graduate professionals who join us become more than clients, but members who get to share in our profits. It's called mutuality, and it's just one of the ways we've been protecting the health and prosperity of professionals for over 70 years.**

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# SAIEE Membership Benefits

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

You simply cannot afford not to be a member!

- A discount of up to R1110 on their ECSA registration fee, which is due in April every year, provided that they join the SAIEE before the end of March that same year.
- Upon joining the SAIEE there is a standard entrance fee of 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
www.saiee.org.za

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

## JULY 2012

| | | | |
|---|---|---|---|
| 2 | EWEA Technology Workshop: Analysising Wind Farms | Lyon, France | www.ewea.org/techworkshops |
| 3-5 | 2012 Intl Conf on Power Engineering and Renewable Energy | Bali, Indonesia | www.icpere2012.org |
| 9-13 | Power Africa 2012 | University of Witwatersrand, JHB | www.powerafrica2012.com |
| 11 | Women's Networking Breakfast | Sunnypark Hotel, JHB | 011 487 3003 |
| 15-17 | SAITEX 2012 | Gallagher Convention Centre, Midrand, JHB | www.exhibitionsafrica.com |
| 16-19 | Africa Mining Congress 2012 | Sandton Convention Centre, Johannesburg | www.terrapinn.com |
| 20 | East Africa Business Summit & Expo 2012 | Hilton Sandton Hotel, Johannesburg | www.eastafricabse.com |
| 24 | 2012 International Conference on Smart Grid Systems | Kuala Lumpur, Malaysia | www.icsgs.org/cfp.htm |
| 24 | 2012 4th Intl Conf on Mechanical and Electrical Technology | Kuala Lumpur, Malaysia | www.icmet.ac.cn |

## AUGUST 2012

| | | | |
|---|---|---|---|
| 2-4 | Conf: Advances in Power Conversion & Energy Technologies | Mylavaram Andhra Pradesh India | www.lbrce.ac.in/apcet |
| 13-17 | The Cosmic Kaleidoscope: Pulsars and their Nebulae, Supernova Remnants and More | Kruger Park, South Africa | fskbhe1.puk.ac.za/knp2012/ |
| 15 | IP Expo | Sandton Convention Centre, JHB | www.ipexpo.co.za |
| 17 | 2012 Intl Conf on Electrical Engineering and Comp Science | Shanghai, China | www.iceecs.org |
| 27-29 | 2012 IEEE Intl Conf on Smart Grid Engineering (SGE) | Oshawa, Canada | www.ieee.org |

## 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 |

## OCTOBER 2012

| | | | |
|---|---|---|---|
| 8-9 | 2nd Annual Smart Grid And Smart Meter Summit | Abu Dhabi, UAE | www.fleminggulf.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 |
| 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 |

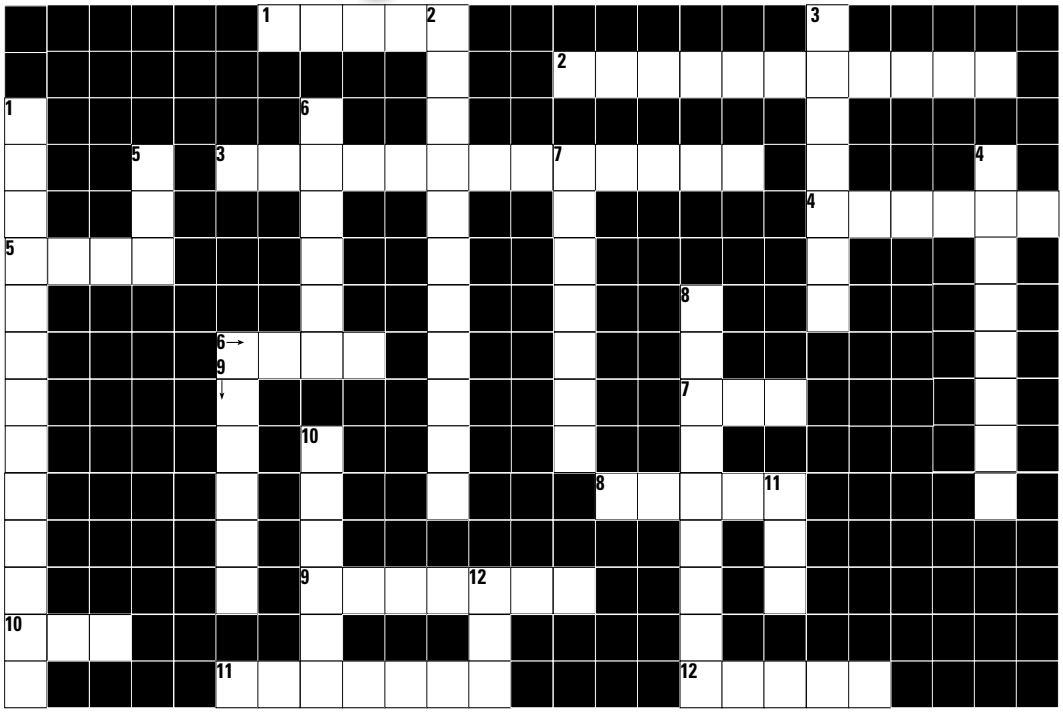
Have some fun and stand a chance to win R1000. Complete the June issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, Jume Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **31 July 2012**. The winner of R1000 will be announced in the August issue of the **watt**now magazine.

# R1000 win

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

## ACROSS

1. Who is the designer of the PlanetSolar? (5,6)
2. Radiant light and heat from the sun. (5,6)
3. A solar cell is a device that converts light into electric current using what effect? (5,8)
4. What is the name of the new photovoltaic plant which will be located in Dibeng, Northern Cape? (6)
5. What type of technology is engineering at molecular scale? (4)
6. Engineering Council of South Africa abbr. (4)
7. Concentrated Solar Power. abbr.(3)
8. The German engineer who developed a photo cell using silver selenide in place of copper oxide - in 1931. (5,5)
9. The name of the catamaran that runs solely on energy found in light. (7)
10. Name of Mrs Mosely, who heads up CPD & Technology leadership at the SAIEE. (3)
11. Who invented the silicon solar cell in 1941? (7,3)
12. See 8 across



## DOWN

1. What did the French develop in 1888? A solar powered ___ (8,5)
2. What converts solar light to heat? (11)
3. The name of the biggest Solart Power Station in the world. (7)
4. $10^{15}$ W (8)
5. International Organization for Standardization. abbr. (3)
6. Who is the designer of PlanetSolar? (5,6)
7. Who constructed the first solar cell? (7,6)
8. Who invented the solar panel? (6,9)
9. See 8 Down.
10. See 7 Down.
11. See 11 Across.
12. Zero (3)

CONGRATS

**April issue Crossword Winner:**
**Frank van der Velde from Cape Town**

**ACROSS 1** DMM **2** Solar Regulator **3** OWTL **4** GPS **5** Photovoltaic **6** Andries **7** CRT **8** Brush **9** Oscilloscope **10** Australia

**DOWN 1** PowerGen Africa **2** Mike **3** HAWT **4** South Africa **5** NLD **6** Albert Betz **7** CPD **8** Flow **9** Roland **10** Charles **11** Naidoo **12** Hill

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. **watt**now magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the **watt**now magazine. 7. Closing date for entry is 31 July 2012. 8. The winner will be announced in the August issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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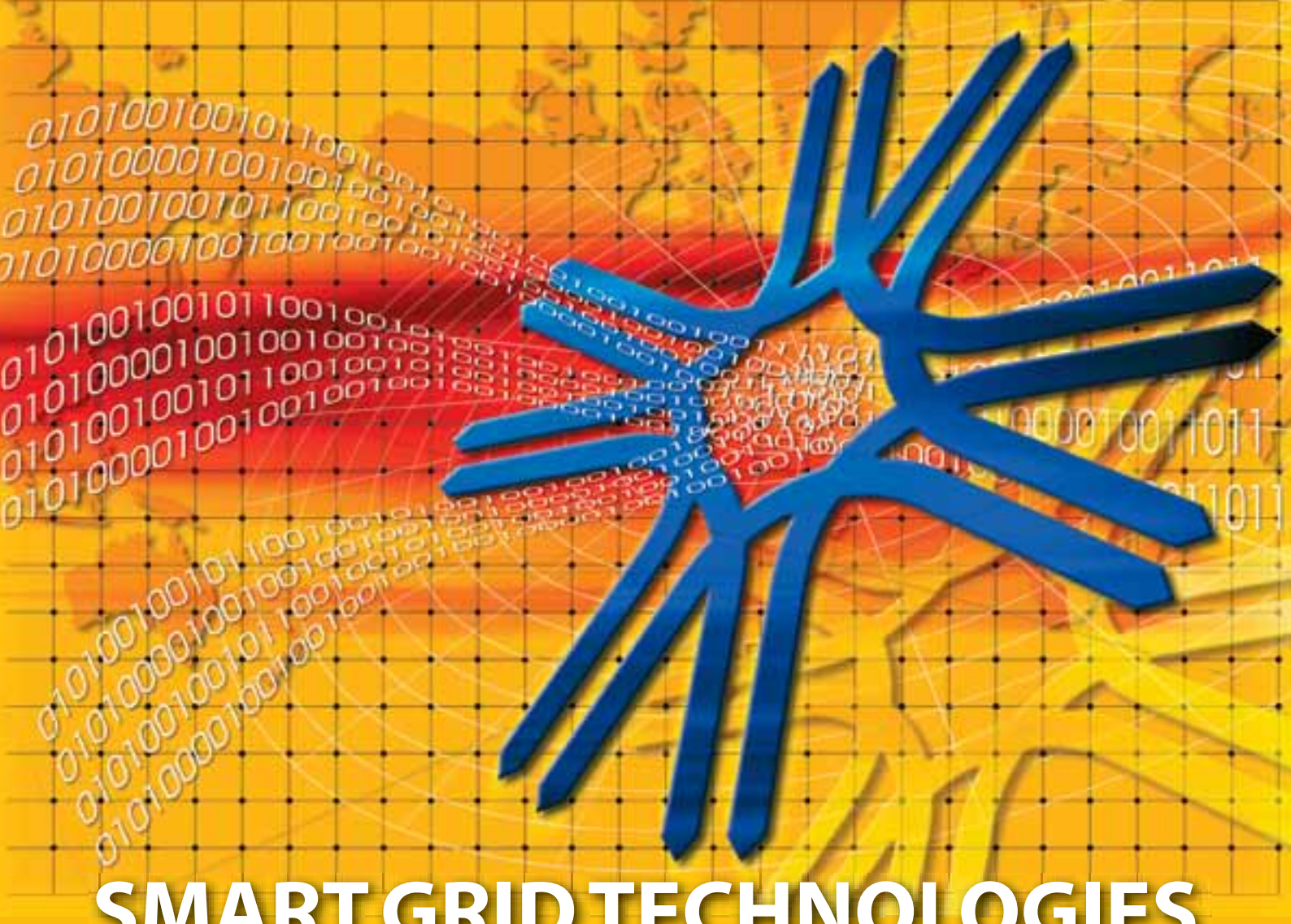

# SMART GRID TECHNOLOGIES

## Power Line Communications

## Power Electronics

### International Syposium on Powerline Communications and its Applications

### IEEE 2013 - Hosted by the University of Johannesburg


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