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wattnow magazine

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My word - we have been busy since the last wattnow was published! The SAIEE entertained a few guests and members to various events.

The Bernard Price Memorial Lecture, which took place at the Wits Medical School, was such an auspicious event with the lecturer being none other than the "Father of the internet", Dr. Vinton G. Cerf. The SAIEE reached a milestone in streaming the lecture live and managing to get its # bpml2013 trending on twitter. Read more about Vinton Cerf on pages 10 and 40.

The second event was the SAIEE Charity Golf Day. This was truly an amazing and successful day, which saw everyone walking away with a prize or two. Thank you to all the sponsors for your valuable contributions. Without your sponsorship, this event would not have been successful! Look at the photos on page 14.

This issue theme around Lighting and Morad Fachot from IEC penned a few articles on this topic. He discusses every aspect of lighting, from the ever-expanding technology involved to urban lighting and the usage of LED's in motor vehicles which enhances driver's capabilities in severe weather. Read his contributions from page 28.

The Annual SAIEE Banquet is around the corner and things are coming together nicely. We honor and award the engineers who have made a difference in the industry. We are also adding another trophy to the mix, which will be awarded to the Advertiser of the Year. Contact Gerda Geyer to secure your tickets to this auspicious event. Watch out for your next issue, which will be going to print late due to the banquet, which is taking place on the 1st of November.

I wish you an 'enlightened' month.

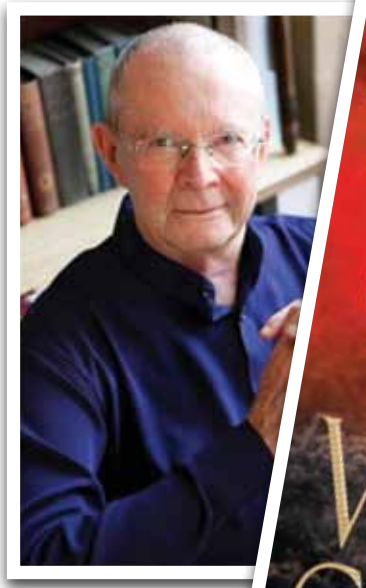
Happy reading.

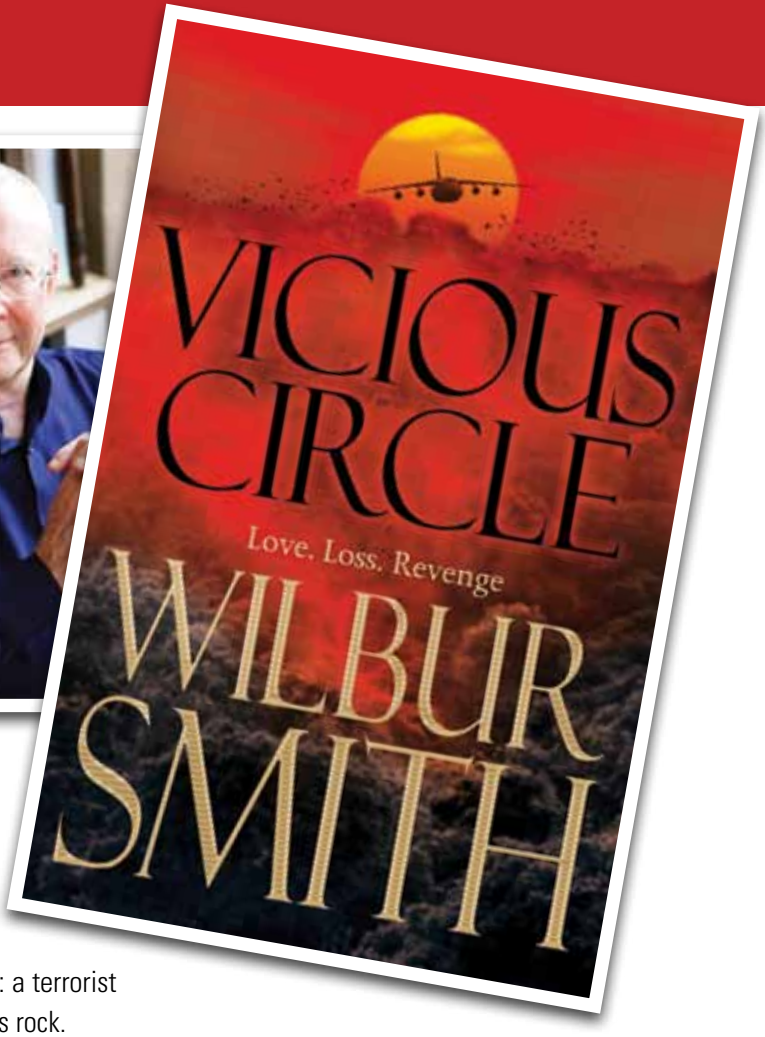
Minx

Earn CPD Credits

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

Vicious Circle





BY I WILBUR SMITH

Wilbur Smith is a No. 1 global bestselling living legend.

His new novel, Vicious Circle, is a contemporary action-packed thriller set in Africa and the Middle East. When Hector Cross's new life is overturned, he immediately recognises the ruthless hand of an enemy he has faced many time before: a terrorist group has re-emerged – like a deadly scorpion from beneath its rock.

Determined to fight back, Hector draws together a team of his most loyal friends from his former life in Cross Bow Security, a company originally contracted to protect his beloved wife, Hazel Bannock, and her company, the Bannock Oil Corp. They travel to the remotest Middle East, to hunt down those who pursue him and his loved ones.

Hazel and Hector have a child, a precious daughter, who he will go to the ends of the earth to protect. Brutal figures from the Bannock family's past – thought long-gone – are returning, with an agenda so sinister that Hector realises he is facing a new breed of enemy. One whose shifting attack and dark, shocking secrets take Hector to the heart of Africa and to a series of crimes so shocking they demand revenge.

Wilbur Smith was born in Central Africa in 1933. He was educated at Michaelhouse and Rhodes University. After the successful publication of WHEN THE LION FEEDS in 1964 he became a full-time writer, and has since written over 30 novels, all meticulously researched on his numerous expeditions worldwide. His books have been translated into twenty-six different languages and sold over 120 million copies worldwide.

Published by Macmillan in October 2013. RRP: Hardback R299

The **watt**now magazine has two books to give away.
Answer this question: ***Where in Central Africa was Wilbur Smith born?***
Send the answer with your details and physical address to
minx@saiee.org.za - Subject line - *Wilbur Smith Book Competition*
to reach us by no later than **5 November 2013.**

PAN MACMILLAN

For further biographical information
please go to www.wilbursmithbooks.com
or www.panmacmillan.com

Greetings to you all .

It is really cold and wet in the Southern Cape at this time of the year, in contrast to the generally sunny and dry Johannesburg, however, the fairest Cape is beautiful and green.

We are very fortunate in our beautiful country to have such diverse climate, and relatively pleasant winters when compared to the Northern countries. However, we still have a period of extreme cold which of course creates a peak in domestic energy demand that Eskom are expected to cater for at short notice.

Invariably, at this time of the year, Eskom will be forced to cope with sudden increases in demand by firing up the open cycle gas turbines that consume vast quantities of diesel – which is that other scarce commodity in our energy starved country, and another reason for the cost of diesel to the domestic user.

Renewable energy resources are not of much help to alleviate the critical shortage of energy during overcast and wet days, as most really cloudy days do not have much wind either. So, we are left with energy efficiency and sophisticated, "smart' energy management.

I had the pleasure of doing a keynote address on behalf of the SAIEE at the ICUE (Industrial and Commercial Use of Energy Conference) in Cape Town. This was the tenth anniversary of the conference in its current form, and it was once again held at the beautiful Vineyard Hotel in Newlands – Cape Town. The inaugural ICUE conference was hosted at the Lord Charles Hotel in Somerset West in 2004, and has since been held in various venues in and around Cape Town.

The ICUE is organised by the Cape Peninsula University of Technology in partnership with Eskom. The primary objectives of the ICUE are to focus and stimulate debate regarding energy consumption, its trends, optimisation and technology advancement in South Africa.

This year was no exception, and some very interesting papers were presented by prominent international academics and practising Engineers. The ICUE provides business partners, academics and energy experts with a platform to network and strategize in order to address the needs of various sub sectors within the economy.

In one interesting academic paper presented by Pepijn van Willenburg and Johan Woudstra, both from The Hague University of applied Sciences in the Netherlands, in their paper, "An introduction to Direct Current Distribution Grids" they refer to the continuously increasing demand for energy in commercial, domestic and transportation fields being direct current.

They claim that solid state appliances in Europe define the 'new' electric world. They are suggesting that sustainable energy produced by renewable energy plants could be used directly for supply to domestic consumers, rather than installing expensive inverters.

They further suggest the introduction of large scale Smart DC Mini- Grids with renewable energy based distributed generation. In strikes me that should DC appliances be readily available, this could be a solution for the ever increasing need for low cost rural electrification, and can be used in Africa to provide the domestic requirements in rural areas. When one thinks of it, the majority of domestic energy needs can be provided by a DC supply such as lighting, (LED's) cooking, mobile telephone chargers, radio, television computers, just to name a few, while other domestic appliances can relatively be converted to DC with relative ease.

Several other very interesting and innovative papers were presented at the conference, which gives me confidence in the Electrical Engineering fraternity in South Africa.

Paul van Niekerk | Pr. Eng | FSAIEE
SAIEE President 2013

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WATTSHOT

Christmas just wouldn't be Christmas without a variety of magical twinkling lights. There is something so inviting, cosy and magical about lighting up festive evenings with the sparkle of many small lights – it really adds to the Yuletide atmosphere and the enchantment of this time of year. Whether you want to light up your Christmas tree, your home, patio, garden or festive table setting – you will need to add some evening sparkle!

Fairy Lights - Warm White

Osram LED fairy lights warm white on black string (Code: 10349) - 10m.
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LED warm white fairy lights on green string (code: 10471) - 10m.
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Fairy Lights - Colour

LED colour fairy lights on green string (code: 10470) - 10m.
Price: R349.95 (incl. VAT)

Solar Fairy Lights

White solar fairy lights with 5m green string (code: 17740)
Price: R129.95 (incl. VAT)

Solar Fairy Lights - White

White solar fairy lights with 5m green string (code: 18507).
Price: R139.95 (incl. VAT)

Solar Fairy Lights - Colour

Multi-coloured solar fairy lights with 5m green string (code: 18656)
Price: R129.95 (incl. VAT)

All the products featured on pages 8 & 9 are available from The Lighting Warehouse | www.lightingwarehouse.co.za.

Solar Lanterns

White solar lantern string (code: 17741)
Price: R129.95(incl. VAT)

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Multi-coloured solar lantern string (code: 18657) - Price: R129.95 (incl. VAT)

Solar Snowball

Solar snowball string (code: 18082)
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Solar Rope

White solar rope (code: 18081)
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Solar Bubbles

Solar bubble set (code: 17742)
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Price: R499.95 each (incl. VAT)

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Mooni solar "Blowfish" table lights (code: 18913)
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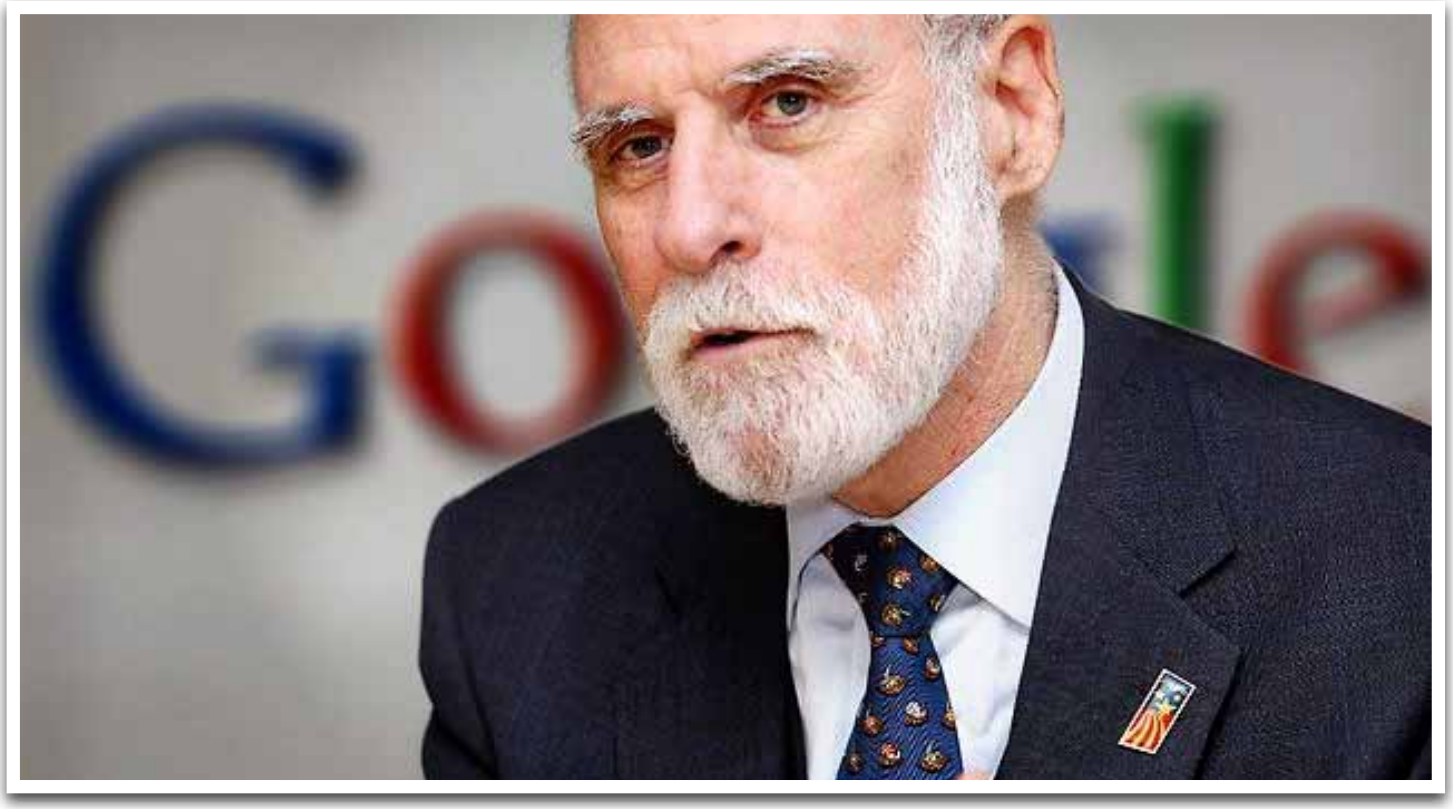
WATTSUP

62ND BERNARD PRICE MEMORIAL LECTURE



The "Father of the Internet" - Vinton G. Cerf

The annual tradition since 1951, affords the SAIEE to play co-host with the University of Witwatersrand (Wits) to the Bernard Price Memorial Lecture. This year, the lecturer for the 62nd Bernard Price Memorial Lecture is widely known as one of the "Fathers of the internet", Vinton G. Cerf. He has served as vice president and chief internet evangelist for Google since 2005.

For the first time the Institute was able to broadcast the BP Lecture live and in keeping to the theme of Cerf's presentation which was based on developments in technology and the sharing of information through the internet. The SAIEE was able to share this fully booked presentation with its members and the general public online as Professor Cerf was only available for the night and could not participate in the customary tour to the various SAIEE Centres throughout the country.

The team at Google Africa and Wits University contributed a great deal in the successful online broadcast of this lecture. Wits recorded the high definition presentation which was transmitted to Google's video chat service, Google Hangouts. From their it was streamed live to the SAIEE Youtube channel, SAIEETV, which was also embedded onto a news page of the SAIEE website. This allows the live presentation to be seen by those who couldn't get a seat or attend the Johannesburg hosted event.

The successful broadcast was fuelled further on social media earning the #bpml2013 trending status on twitter in South Africa. The video has since been viewed 245 times and can still be viewed online through the SAIEE Youtube channel - www.youtube.com/saieetv. Read how instrumental Cerf was in the TCP/IP Protocol development on page 40.

AFL TEST AND INSPECTION AND COMTEST JOIN FORCES

AFL has appointed Comtest Technologies (Pty) Limited (COMTEST) as its sole distributor in South Africa and selected countries in southern Africa, for its test and inspection products. AFL manufactures, engineers and installs the fiber optic products and equipment that communications providers need to provide quad-play solutions to their customers. AFL's test and inspection products consistently meet and exceed customer needs, delivering exceptional fiber optic test equipment and outsanding service.

Nick Cole, AFLs Regional Sales Manager for the Test and Inspection Division, South Africa, has confidence that COMTEST will take AFL sales to new heights and quickly become a leading force in the test and inspection market in South Africa.

"AFL's ISO certification and quality practices ensure you receive excellent products and documentation," says Cole.

"Our products are designed to provide accurate results every time. They are engineered to endure outside plant environment and feature intuitive user interfaces that provide quick results without complicated training requirements.

We believe that COMTEST has the right mix of people with technical and industry knowledge to make any customer feel comfortable with his/her choice of AFL product and ensure that they receive the solution that fits their every need."

Gary Casper (left), Comtest product specialist will spearhead sales and marketing for the new agency AFL, shakes hands with Nick Cole, AFLs Regional Sales Manager (SA).

Gary Casper, the Comtest product specialist who will spearhead the sales and marketing for the new agency, is no newcomer to the telecomunications market or the products which he will now be selling.

Casper has successfully been involved with this industry since COMTEST's inception, overseeing major projects such as the delivery, installation and handover of the fibre optic test system for Broadband Infraco some years ago.

Casper says: "I am delighted to represent AFL in South Africa. We're going to the market with an excellent range of world class products which will be supported by a high level of service from people with specialist knowledge and expertise".

TELKOM LAUNCHES OPEN INNOVATION MEGA CHALLENGE AT SA INNOVATION SUMMIT

Telkom announced the Open Innovation "Mega Challenge" to all South African innovators, calling on them to think innovatively about Telkom.

The company has invited all small and medium business, universities, research institutes, not-for-profit organisations, start-ups, individual inventors and innovators to collaborate with Telkom by responding to the challenge with innovative proposals for technologies and solutions.

Says Telkom's Managing Executive of Product House, Mr Steve Lewis, *"As a leading communication provider and, by extension, a facilitator of the innovative spirit, Telkom has always endeavoured to inculcate innovation into its business operations."*

The challenge set by Telkom is based on a theme of products for the future that will stimulate and drive broadband growth. The focus areas include, but are not limited to, convergence; cloud solutions; vertical segment solutions; machine to machine solutions, smart buildings and smart cities.

Entries are judged on their innovation, feasibility, commercial viability, market appeal, must directly benefit economic growth and social development and also stimulate broadband penetration.

A total of R200 000 worth of cash prizes and Telkom products and services will be awarded for the three best submissions. First prize will be awarded R120 000 and free 40 Mbps DSL service (where available) for 24 months with Uncapped usage and a VDSL modem; second prize will be awarded R50 000 and free 10 Mbps DSL service for 24 months with Uncapped usage and a VDSL modem and third prize will be awarded R30 000 and Free 10 Mbps DSL service for 24 months With Uncapped usage and a VDSL modem.

Closing date for submissions is 30 November and winners will be announced at the end of March 2014.

"This challenge and its theme illustrates Telkom's forward thinking disposition and points to the rapid changes that characterise the ICT sector," says Mr Lewis. *"We are keenly aware that in an environment of hyper-competition, competitive advantage is linked to intangible resources that are rare and difficult to imitate. The most valuable of these is the ability to innovate. The Mega Challenge forms part of this corporate imperative,"* concluded Mr Lewis.

WATTSUP

wattnow NETWORKING BREAKFAST

*Left to Right: Alec Hogg (Guest Speaker), Minx Avrabos (Managing Editor, **watt**now) and Paul van Niekerk (2013 SAIEE President).*

A beautiful spring morning saw another succesful networking breakfast hosted by Minx Avrabos, Managing Editor of the **watt**now magazine. The speaker, Alec Hogg, entertained the guests with his talk about *"Tap dancing in a warp speed world"*.

Alec Hogg informed us how to flourish personally and financially in the rapidly transforming environment we now inhabit.

This breakfast was by invitation only - a small token of thanking the **watt**now advertisers for their continual support. Everyone left feeling optimistic about our country and it's economy!

Martin Bastiaans (IEEE) and André Hoffmann

Minx Avrabos, Stan Bridgens and John Gosling

Scott Williamson (ARB), Patrick O'Halloran (City Power) and Graham Whittle (Impact Energy)

Justin Blake, Max Clarke, Jeanette Hogg and Alec Hogg

Colleen Russell (Elcon) with Derek Woodburn.

Angus Hay (Neotel), Alec Hogg and Stan Bridgens.

Craig Smith (SAIEE) and Barbara Spence (Avenue Advertising).

Haydn du Plessis (Resolution Circle) with Minx Avrabos.

Michael Crouch with Tracey Human (SAIEE).

ALTRON'S POWERTECH TRANSFORMERS RECEIVES A R350 MILLION MINIATURE SUBSTATION CONTRACT

Powertech Transformers, a subsidiary of Powertech and the JSE listed Altron Group has received the majority share of the miniature substation contract from Eskom to the value of approximately R350 million. The contract, which covers a two year period from August 2013 to July 2015, comprises miniature substations which will be supplied to Eskom nationally.

The miniature substations are intended for various housing developments throughout South Africa where Eskom supplies power. These substations will be manufactured locally in Powertech Transformers' Cape Town factory and transported from there to locations where they are required in terms of the Eskom contract.

Commenting on the contract, Bernard Meyer, CEO of Powertech Transformers said, "*We are delighted to be awarded this large order. Obtaining repeat business in a highly competitive domestic market from a key customer such as Eskom, confirms their confidence in us as a strategic local partner as well as their commitment to their localisation programme which benefits South Africans directly.*"

With the equivalent of approximately 80 miniature substations of various sizes being supplied per month over 24 months, this contract constitutes a significant contribution to supporting local manufacturing and retention of jobs in the Cape Town region.

Powertech Transformers supplies a full range of transformers, from generator step-up to transmission and distribution transformers in its three factories. The range includes three-phase and single-phase units, auto-transformers, arc-furnace, locomotive and traction transformers, miniature sub-stations, NECRT's as well as LNER's and shunt reactors.

GAST ANNOUNCES RECORD GROWTH

Kevin Gast | CEO | GAST

Following the announcement that engineering solutions provider, GAST had withdrawn from their Medupi Power Station contract with Basil Read, the company has recently provided a further update to the proceedings.

GAST CEO, Kevin Gast met with the former Deputy CEO of Basil Read, Donny Gouveia who has since resigned, in an attempt to amicably resolve the matter. Regrettably, by mutual agreement it was decided that an equitable solution could not be reached, and the matter will be heard through arbitration.

GAST has subsequently announced a record order book reflecting more than 35% growth year on year, which includes additional Eskom related contracts to the value of R70 million. Furthermore, GAST's roads, paving and construction divisions have also been awarded contracts to the value of R320 million.

UKZN UNVEILS SMART GRID RESEARCH CENTRE

Deputy Minister Public Enterprises Mr Bulelani Magwanishe unveils the commemorative plaque at the Smart Grid Research Centre on the Westville campus. From left: Professor Nelson Ijumba, Deputy Minister of Public Enterprises Bulelani Magwanishe,Deputy Mayor of eThekwini Nomvuso Tshabalala and the CEO of Eskom, Mr Brian Dames.

The Smart Grid Research Centre was officially launched at UKZN's Westville campus recently. The Research Centre will assist in developing the Smart Grid System for South Africa and is the only simulator of its kind in the Southern Hemisphere.

In his address Professor Nelson Ijumba said: *'Eskom's student support and investment in research infrastructure at UKZN gives a new context to corporate social responsibility. It has empowered individuals, capacitated the Institution and benefited the community at large.'*

The Smart Grid Research Centre along with the High Voltage Direct Current Centre and the Vibration Research and Testing Centre forms part of the Science and Technology Innovation Park (STIP).

STIP was established as a partnership between UKZN and Eskom to foster research for product advancement and innovation through knowledge partnerships.

WATTSUP

THE ANNUAL SAIEE CHARITY GOLF DAY

It was a lovely hot day at the Randpark Golf Club where the 2013 SAIEE Charity Golf Day took place. With 18 4-balls sold, it turned out to be a tremendous success.

Mr Paul van Niekerk, 2013 SAIEE President, said at the dinner and prizegiving: "*All of you made a difference for being here and I thank you.*"

Paul van Niekerk's charity of choice who will benefit form this golf day, is the Girls & Boys Town of South Africa.The official cheque handover will take place on the 1st of November during the Council Meeting.

The SAIEE would like to thank all the sponsors for the Golf Day, without you, this event would not have been a success.

Our SAIEE Golf bags with Cap for the golfers.

Team Nynas.

Golf Day Sponsor: ACDC Express

Taking a break with sponsor Quanta Soltutions.

Team Impact Energy.

Golf Day Sponsor: Kainos

Golf Day Sponsor: RMS

Team MNet taking a drinks break with ICMEESA

Team ICMEESA

Winners of the 2013 SAIEE Charity Golf day: Team Sebata Group

2nd place Winners of the 2013 SAIEE Charity Golf day: Team Nynas

3rd place Winners of the 2013 SAIEE Charity Golf day: Team ICMEESA

Matome Modipa, winner of whiskey sponsored by RMS.

Dylan Collis, winner of the nearest to the pin, 15th hole.

Leon Baker, winner of nearest to the pin, 6th hole.

Justin Pullinger winner of the Longest Drive.

Koos v Rensburg, nearest to the pin, 15th hole .

Team ICMEESA 1

Team Actom

Team ICMEESA 2

MC: Patrick O'Halloran

Team ACDC Express

Team CBI

Team Kainos

Team Quanta Solutions

Team Zest

Team Remote Metering Solutions (RMS)

Team Impact Energy

Team City Power

Team Actom

Wayne Bromfield from Impact Energy, the raffle winner of the Putter sponsored by Paul Tuson of PB Power.

Team ACDC

Wayne Bromfield (r) with the raffle sponsors of goodies from Srixon.

Organisers of the Golf Day: Minx Avrabos & Gerda Geyer with Paul van Niekerk.

WATTSUP

ACTOM CELEBRATES 50 YEARS IN BUSINESS

To mark the celebration of its 50th anniversary this year, ACTOM Power Transformers held a cocktail party at its Germiston premises.

The 50th anniversary function coincided with the official opening of the company's recently upgraded test facility, following the latest expansion of its plant capacity to include production of 315 MVA generation and transmission transformers for Eskom. The new test facility, established at a cost of over R30-million as an addition to the company's existing test facility, is the most advanced facility of its kind in Africa and one of the best in the world.

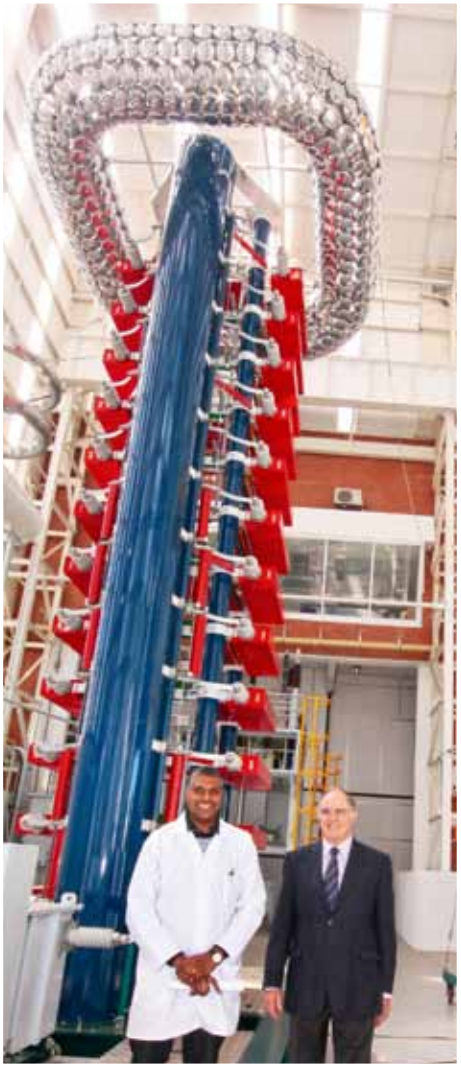
Addressing guests at the 50th anniversary function, ACTOM's Group Executive Director Andries Tshabalala said: *"During the 12-year period since being acquired by ACTOM, the company's turnover has increased 5,8 times or 600%."*

To illustrate this, Tshabalala pointed out that the company's highest rated transformers have progressively increased from 40 MVA at 132 kV in mid-2007 to 315 MVA at 275 kV today.

Ronnie Russell, ACTOM Power Transformers' Divisional CEO, is by far the longest serving of the three CEO's who have headed up the company since its inception, having served for 28 years in this capacity. *"He has also been with the company for almost as long as it has existed – 47 years,"* Tshabalala commented in his speech.

"In fact there are quite a number of other senior executives, as well as other employees, who have over 40 years' service with the company – as has been the case in the past. This demonstrates the high level of expertise that has been retained within the company over the years, which has contributed significantly to its success."

"It also shows that the company is a model of staff loyalty and stability, which is what most companies seek to achieve, but few manage to do as successfully as ACTOM Power Transformers has done," Tshabalala concluded.



ACTOM Power Transformers' Divisional CEO Ronnie Russell (right) and Quality Manager Mohamed Alli stand beside the 2,4 MV impulse generator in the company's new world-class test facility.

ENERGY TRAINING WORKSHOP FOR GDID

Yu-Chieh Liu (MSc Electrical Engineer), Oliver Chimusoro (Chief Engineer, PhD Student), Gareth Sessel (MSc Electrical Engineer), Calvin Baloyi (Electrical Engineer), Tiishetjo Ntsoane (Town and Regional Planner), Hashim Molvi (corner)Town and Regional Planner, Benjamin Mathibeng (Mechanical Engineer), Talifhani Masibigiri (Electrical Engineer), Ouma Mosala (Mechanical Technician), Diana Rampou (Town and Regional Planner), Kgantshi Motloutsi (Mechanical Technician), Fezile Nkosi (Town and Regional Planner), Willie Cronje (Professor of Engineering)

On the 16th of August 2013 Wits EIE hosted an energy training workshop for members of the Gauteng Department of Infrastructure Development. The attendees ranged from graduate engineers through engineering technicians to town planners.

The course focused on fundamental energy principles and their application to renewable energy systems and green buildings. The course workshop was tailored for the audience and provided opportunities for hands-on learning with well-chosen experiments to elucidate energy principles. It also include show-an-tell visits to the PV installations on campus. This effort seeks to support the Gauteng Government's Green Economy Agenda. The effort was initiated under the newly founded Alstom Chair for Clean Energy Systems Technology (ACCEST) in the School of Electrical and Information Engineering.

NEW INTRINSICALLY SAFE INFRARED THERMOMETER

The Comtest Group, Fluke's authorised Test and Measurement distributor, has announced the arrival of the newly launched Fluke 568 Ex, intrinsically safe (IS) infrared thermometer which meets intrinsically safe certifications from all major safety agencies for Class 1 Div. 1 and Div. 2 or Zone 1 and 2 hazardous environments.

Ideal for use in environments such as petroleum, chemical, oil and gas or pharmaceutical environments, the Fluke 568 Ex is one tool that can be used anywhere, worldwide.

The unit measures between -40°C to 800°C with ±1% accuracy. Measurements from further away are accurate with a 50:1 distance-to-spot ratio. The Fluke 568 Ex captures up to 99 points of data and is versatile, with a multiple language (user select) interface and adjustable emissivity, built-in material table.

The Fluke 568 Ex is compatible with standard K-type mini-connector thermocouple probe (KTC) and is shipped with a conductive case for carrying into hazardous areas. It also carries the standard Fluke 2-year warranty.

Fluke's 572-2, high temperature, infrared thermometer

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PROFESSOR WINS MEDAL FOR GRAPHENE RESEARCH

Alexander Balandin will receive the MRS Medal, one of the highest honors in materials science, on the 4th of December.

A University of California, Riverside electrical engineering professor will receive the 2013 MRS Medal for his work on thermal properties of graphene, a single atomic plane of carbon atoms, and development of a new materials characterization technique.

Alexander A. Balandin, who is also the founding chair of the materials science and engineering program at UC Riverside's Bourns College of Engineering, will receive the MRS Medal on the 4th of December 2013 in Boston. The MRS Medal is awarded annually by the Materials Research Society for a specific outstanding recent discovery or advancement that has a major impact on the progress of a materials-related field. It is one of the highest recognitions a materials scientist can receive.

Balandin is being honored for his discovery of unusual thermal properties of graphene and two-dimensional crystals, development of an original optothermal measurement technique for the investigation of thermal properties of graphene, and theoretical explanation of the unique features of the phonon transport in graphene.

Balandin pioneered the graphene thermal and phonon engineering fields, which resulted in major advances in understanding the thermal properties of low-dimensional materials, physics of phonons, and led to development of practical applications of graphene in heat removal and thermal management. Balandin's contributions range from the first-principle theory to experiments and to demonstration of prototype devices.

Phonons are quanta of crystal lattice vibrations that carry the heat, affect the optical response of materials and scatter electrons, thus limiting electrical conduction. Phonons reveal themselves in all electrical, thermal and optical phenomena in materials.

In the late 1990s, Balandin recognized that nanostructures open opportunities for tuning the properties of phonons in a way similar to electrons. An approach for controlling the phonon spectrum of materials for specific applications was termed phonon engineering or nanophononics.

The advent of graphene and quasi two-dimensional materials, also referred to as van der Waals materials, resulted in

Alexander Balandin, a professor of electrical engineering

a discovery of a wealth of new phonon physics and created opportunities for better control of phonon interactions.

The exceptionally high thermal conductivity of graphene can be used in thermal interface materials, heat spreaders and thermal phase change materials, which are used for heat removal from computers, laptops and batteries. Balandin and his group members are currently working on developing practical technologies for graphene applications in thermal management of electronic and optoelectronic devices.

WATTSUP

ENERGY CYBERNETICS ENTERS SOLAR PV MARKET LAUNCHING SUNCYBERNETICS

SUNfarming Head Quarters in Germany, the partners of SUNCybernetics in South Africa

A joint partnership formed between Energy Cybernetics and SUNfarming in Germany has resulted in the launch of SUNCybernetics—small, medium and large scale solar PV solution providers.

In a logical step to offer turn-key energy management and engineering solutions to its clients, 14 year old South African energy management specialist company Energy Cybernetics, has embarked on including PV solar as an option to further expand the energy savings possibilities for clients as part of a comprehensive energy solutions offering.

UJ SOLAR RECEIVES SANEA ENERGY AWARD

Brian Statham, Chairman of SANEA presenting the award to the UJ Solar Project at the 2013 SANEA Energy Awards

The UJ Solar Team was honoured to receive an award from the South African National Energy Association (SANEA) on Thursday, 22 August 2013 at the SANEA Energy Awards. The Solar Project at the University of Johannesburg (UJ) promotes the development of sustainable engineering design, efficient energy use, environmental awareness and innovation. Students design and build solar powered vehicles with the goal of crossing the South African countryside in a 5000 km endurance race. But it is so much more than that, it serves as a platform to promote Science, Engineering and Technology (SET) as an exciting career choice, with the primary purpose delivering engineering graduates who are well equipped to deal with the many challenges in energy innovation

HENRY FERREIRA APPOINTED

Pinnacle Technology Holdings CEO, Arnold Fourie, announced that Henry Ferreira has been appointed as the Head of Distribution for Pinnacle Technology Holdings, effective immediately.

Henry Ferreira, who has filled the role of CEO, AxizWorkgroup, for the past 18 months, will now take on the added responsibility of managing distribution for the Pinnacle Group.

Mr Fourie said that Pinnacle Holdings remains focused on the continuous improvement of their business and that the move will allow the Group to synergize common functions of their broad-based technology distribution centres, ultimately increasing both profit and market share.

"While both companies operate very differently, in mostly varying markets and have very different cultures," Fourie said, *"there are areas where collaboration between the teams will strengthen the Group even further"*.

Mr Fourie added that it was important to note that both entities will remain separate, and will continue to function separately in their specialist areas, but that great advantage could be gained from Mr Ferreira overseeing both businesses.

ZEST WEG GROUP SUPPLIES AUXILIARY TRANSFORMERS TO KUSILE

The Zest WEG Group, a significant player in the African transformer market, has delivered 18 auxiliary transformers to Eskom's new Kusile coal-fired power station about 15 kilometres north of its Kendal Power Station near Witbank, Mpumalanga. This is part of an order placed in 2011 for a total of 42 auxiliary transformers, from 3 MVA to 20 MVA, which will be supplied in consignments until 2016. It is also one of the biggest orders Zest WEG Group has received for a single power station at one time.

Kusile is the second most advanced coal-fired power plant project in Eskom and will be the first power station in South Africa to have state-of-the-art Flue Gas Desulphurisation technology installed to remove oxides of sulphur from the exhaust flue gases. The first unit is planned for commercial operation in 2014, with the last unit expected to be in commercial operation by 2018. The construction of Kusile Power Station will have a major impact on the lives and the economy of the community of the Nkangala District, as homes and social infrastructure are being developed to serve the thousands of contractors working on site.

Russell Finch, Manager
Zest WEG Group's power division.

Dr Stephen A Roosa

ENERGY EXPERT TO PRESENT CERTIFIED RENEWABLE ENERGY PROFESSIONAL TRAINING IN SOUTH AFRICA

Renowned international expert in energy conservation, energy management, urban sustainability and performance contracting, Dr Stephen A Roosa, will be presenting the US-based Association for Energy Engineers (AEE) Certified Renewable Energy Professional (REP) training course in South Africa at its launch in November 2013.

The Energy Training Foundation (EnTF), the approved training partner of the AEE for the Southern African region and training provider for the Southern African Association of Energy Efficiency (SAEE), will be presenting the first Certification programme in South Africa designed to recognise the expertise and experience of professionals involved in the specification and application of renewable and alternative energy technologies, assessment of renewable energy projects, and development of achievable low-carbon and sustainability goals for organisations.

LED LIGHTING THE WAY

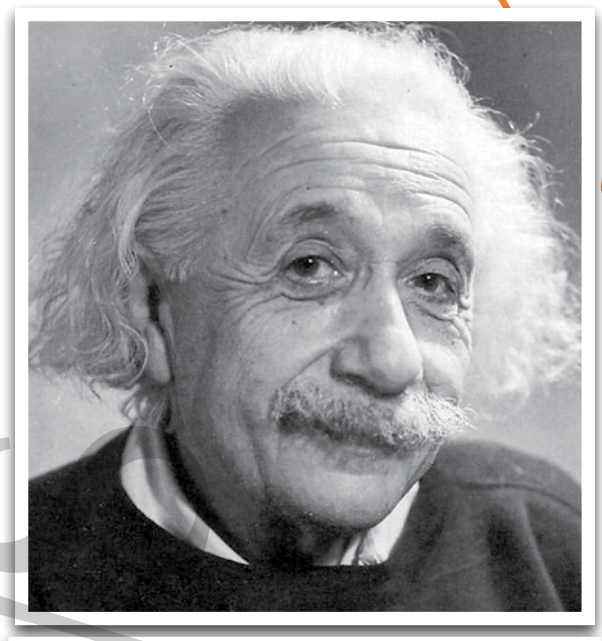
Ultra-modern office and industrial-type LED lights are showing the way for architects and building owners to provide near daylight quality illumination for occupants, while slashing electricity usage by up to 60%.

The range of Skylux Panel lights from architectural suppliers, FG Trading, are a new innovation that fits directly into conventional office ceiling panel fittings. In place of standard, flickering fluorescent tube lighting the new illumination panels provide a bright, natural glow that is glare free and evenly distributed. The lighting is of such a high quality that most fittings are backed with a three year guarantee, providing the building owner with additional peace of mind.

FG Trading managing director, Stuart Fraser, says the new LED Illuminations brand of lights have been specially selected for the South African market and provide high-quality, reliable LED solutions for a wide range of lighting requirements.

FROM ALBERT EINSTEIN TO A SOLAR CITY

22 Facts about the World Energy Congress 2013



To mark the 22nd World Energy Congress, the organisers of the world's most prestigious energy event released 22 facts that help tell the story of this remarkable gathering and the Korean 'solar city' of Daegu in which it will take place from 13 to 17 October 2013.

The fascinating 90-year history of the World Energy Congress has seen contributions from brilliant scientists such as the great physicist Albert Einstein, inspirational speakers including International Space Station astronaut Steve MacLean, and the first discussions of natural gas and nuclear fusion as future energy sources.

This October's Congress theme of 'Securing Tomorrow's Energy Today' will continue that pioneering tradition with sessions on renewable energy, smart grids and future technologies. Host city Daegu, famous for its industry, innovation and culture, is a global renewable energy hub while the EXCO Centre where Congress will meet is one of the world's leading green convention venues. Hwan-eik Cho, Chairman of the World Energy Congress 2013 Organizing Committee, commented: *"The dynamic city of Daegu is an appropriate venue for discussions on the future of world energy. Here our visitors from across the globe will see practical demonstrations of tomorrow's energy today, from the energy-efficient convention centre to an impressive array of the renewable energy technologies that will help power the cities of the future."*

Christoph Frei, Secretary General of the World Energy Council, added: *"Throughout its long and distinguished history, the World Energy Congress has always been a forward looking event. Our predecessors were not afraid to challenge conventional wisdom in tackling the pressing energy issues of their day, and brought some of the world's most brilliant minds to their debates. Daegu will continue that tradition with a visionary agenda and compelling speakers from across the world of energy."*

The World Energy Congress will take place from 13-17 October 2013 at the EXCO Exhibition & Convention Center in Daegu, South Korea. wn

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IN MEMORIUM

Tony Farah

The death of Tony Farah on 10 August 2013 was a great shock to the electrical engineering and high technology business fraternity.

BY I KEN BAKER I COMPSAIEE I HONFSAIMC I LTCDR SANR (RTD)

The large turnout at a Memorial Service held in Woodmead, Johannesburg was a fitting example of the popularity of such a fine gentleman. Friends and family who had had the privilege of working and being associated with Tony gathered at an extremely moving service at "Our Lady of the Cedars" church on 17 August.

To almost the last minute of chatting with his entire family in his home in Bakoven near Camps Bay in Cape Town, he was relentlessly full of humour but he passed away peacefully in his sleep after an uncomfortable period of cancer and bone-marrow degeneration.

Tony was born in Johannesburg of Lebanese parents on 12 November 1948. He matriculated at Marist Brothers, Observatory, JHB and went on to complete a BSc Electrical Engineering degree in 1972 and MBA in 1974 at the University of the Witwatersrand.

In 1990 he took a sabbatical from Spescom to complete an Advanced Management Programme at Harvard Business School. This tertiary education stood him in good stead for the continued development and success of the multinational and JSE-listed Spescom Group which he founded in 1977.

Prior to the founding of Spescom, Tony was an Executive Director at Hubert Davies Electrical Engineering from 1974 to 1977.

During the period 1988 to 1992 Tony served as Vice-President of the Electronics Industry Federation. From 2001 to 2007 he served on the Presidential National Commission for Information and Development as well as Public Administration and Defence.

In 1997 Tony was nominated Lebanese World Businessman of the year by the Lebanese Cultural Union.

On Tony's retirement, after 30 years at the helm of Spescom, this popular and highly respected entrepreneur reminded an interviewer that the group had developed and patented many technologies over the years including "tokenless" prepaid metering, a technology that is now successfully marketed internationally. But during the latter years of his leadership as Executive Chairman and Group CEO, Tony admitted that he found, particularly over those last few years, that the added administration and red tape required by more and more strict corporate governance rules, made it much more difficult to react quickly to market conditions and hindered his entrepreneurial expertise – but, in his words "it's all been a great journey".

He was MSAIEE until the time he resigned from Spescom. On his retirement to Cape Town, Tony established a new Farah investment company – New Investment Creation. This new entrepreneurship involved advising and investing in new innovative ventures as well as a host of financial, marketing, strategic planning and business advice activities.

Finally he was investor/advisor on a new venture at Zulustar - a new Farah family growth company - the activities of which became very close to his heart.

The late Tony Farah is survived by Judy, five adult children and families. Tony's legacy and spirit lives on. wn

City Power network refurbishment and protection

1. The factors below pose a challenge to efficiency of City Power service delivery:

   a. Deterioration of an infrastructure caused by age of the conductor cables and environmental weather conditions.
   b. Constant copper theft and
   c. Vehicle collision with poles.

2. City Power has taken a remedial action to minimize the effect of the above-mentioned unfavourable circumstances by removing the bare overhead cable and replacing it with a 30km of Aerial Bundle Conductor. This aluminum conductor encased in PVC sheathing has proven to be:

   a. More durable in extreme environmental and weather conditions
   b. Not prone to theft
   c. Minimal power loss is experienced when vehicles collide with poles
   d. It contributes to reduction in power failures.

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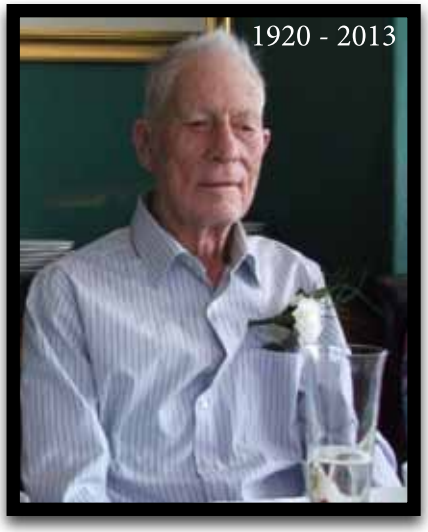

E H Scholes

It is with sadness that we record the death of Edward Henry (Ted) Scholes, a Fellow of the SAIEE and a member since 6th May 1938. He was called to higher service on 28th August 2013 after a short illness, in his 94th year.

BY I MAX CLARKE I FSAIEE

It is with sadness that we record the death of Edward Henry (Ted) Scholes, a Fellow of the SAIEE and a member since 6th May 1938. He was called to higher service on 28th August 2013 after a short illness, in his 94th year.

Ted was born in the Cape on 8th April 1920 and attended Observatory Boys' High school. He won a scholarship to attend Wits University where he graduated in 1941 with BSc degrees in both Electrical and Mechanical engineering cum laude.

At the outbreak of the Second World War he was recruited to the SA War Supplies Board, where he was an assistant production engineer in the aircraft bomb section.

Because he was living in Johannesburg, he was able to pursue his studies at Wits on a part time basis, and in March 1943, he graduated with an MSc in Mechanical engineering. The research for his thesis was on the advantages of using mixed fuels for petrol engines.

With the end of hostilities Ted undertook a two-year post graduate training period with the Brush Electric Company in Loughborough, United Kingdom, and on his return to South Africa in February 1948, he entered service with the Electricity Department of the Johannesburg City Council. This was the start of a career which, after 30 years led to the post of Deputy City Electrical Engineer.

During the 1960's and 1970's Johannesburg experienced exceptional growth. The electricity network was put under severe strain in order to keep abreast of the developments. As a result of his foresight, technical acumen and pragmatism, he was able to meet the challenges resulting from this growth.

Much of the foundation of the stable network that we enjoy today was due to his talent. It was his initiative that resulted in the conversion of the existing 88/20/6,6 kV and 380V distribution network to 88/11KV and 400V and the use of 6,6kV cables for 11kV duty after upgrading of the terminations.

He engineered the supply side by upgrading the switching yards at the Kelvin and Orlando power stations, and planning the new transmission link to the Prospect sub-station. He also foresaw that this link should be designed for 275V even though its initial operational voltage was 88V.

Ted was very much an "outdoor" man. He developed an interest in mountaineering from an early age and, amongst other things, loved climbing Table Mountain. He considered the cable car to be "for tourists", ...real men went to the top on foot !

He pioneered many climbs in the Magaliesberg, Drakensberg and other mountains and he and his colleagues in the Mountain Club were the first to scale the "front" wall of Giants Castle and most notably the Devil's Tooth in the Mont-au-Sources area.

He leaves his wife Mavis, to who, and the family, we extend sincere condolences in their bereavement. wn

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Getting innovative about funding

BY I ERIKA VAN DER MERWE

South Africa's young yet lively venture capital ecosystem is building momentum, with the increased availability of funding mechanisms for innovation being one important driver of this growth.

Practitioners in the industry point out that successful venture capital-backed businesses rely on far more than funding. With mentorship of entrepreneurs, access to networks and markets, and an enabling business and regulatory environment being some of the other essential components.

Typically, entrepreneurs perceive access to funding as the major stumbling block to the bringing-to-market of their start-up businesses or ideas. Compared with the established and thriving venture capital networks in some developed-market economies, there is indeed much work to be done in finding financial backing for innovation in South Africa.

Successful models of innovation funding adopted elsewhere in the world entail meaningful support from government, ranging from direct funding to the creation of a supportive environment through sensible incentives that stimulate investment. South Africa gradually is establishing the foundation in this regard, with state funding for research and early-stage ventures available through various structures. An important role-player is the state-funded Technology Innovation Agency (TIA), established to bring very early-stage ventures towards the point of viability and scalability. TIA last year announced that it would make R300m available for early-stage investment.

The Industrial Development Corporation (IDC), another self-funded state-owned entity, also plays a pivotal role in financing innovation. Its venture capital fund is mandated to enable the conversion of technology-rich South African intellectual property into a market-ready product, and ultimately its commercialisation.

The Department of Trade and Industry (DTI) offers funding support for start-ups through a wide range of mechanisms, including the SPII programme, an initiative which the IDC administers on behalf of the DTI. The DTI recently launched a dedicated website to make the selection and application for the various initiatives much simpler for entrepreneurs – a positive step in an environment mired in red tape.

Compared with government initiatives, private-sector funding for innovation in South Africa is less concentrated and fairly diverse in form, and has grown substantially in recent years. Institutional investment into venture capital funds by private-sector institutions is rare: Pension funds, life insurers and banks are focused instead on funding more

An amendment in recent years to the South African Income Tax Act has created a welcome inducement for individuals, trusts and companies to invest into innovation.

established technologies and businesses, usually through listed assets or private equity.

Venture capital funds rely on investment from corporates, government, development finance institutions and family offices. The number of South African funds, as well as the value and volume of transactions, is increasing. There is also substantial interest from offshore investors and funds for active participation in the local venture capital industry. Current legislation weighs on this process though.

There has also been the establishment of angel networks, as angel investors are a critical part of the funding ecosystem and work closely with venture capital funds. Angel investors are wealthy individuals who usually are entrepreneurs in their own right, with an understanding of venturing and a passion for giving back to the start-up community. Their backing may come in the form of allocations into a venture capital fund, in which case they do not play a role in the selection of the underlying technologies and entrepreneurs.

Angel funding in other instances is channelled directly to the entrepreneur, through regular pitching sessions held by dozens of incubators and accelerators across the country, or through the angels' own networks.

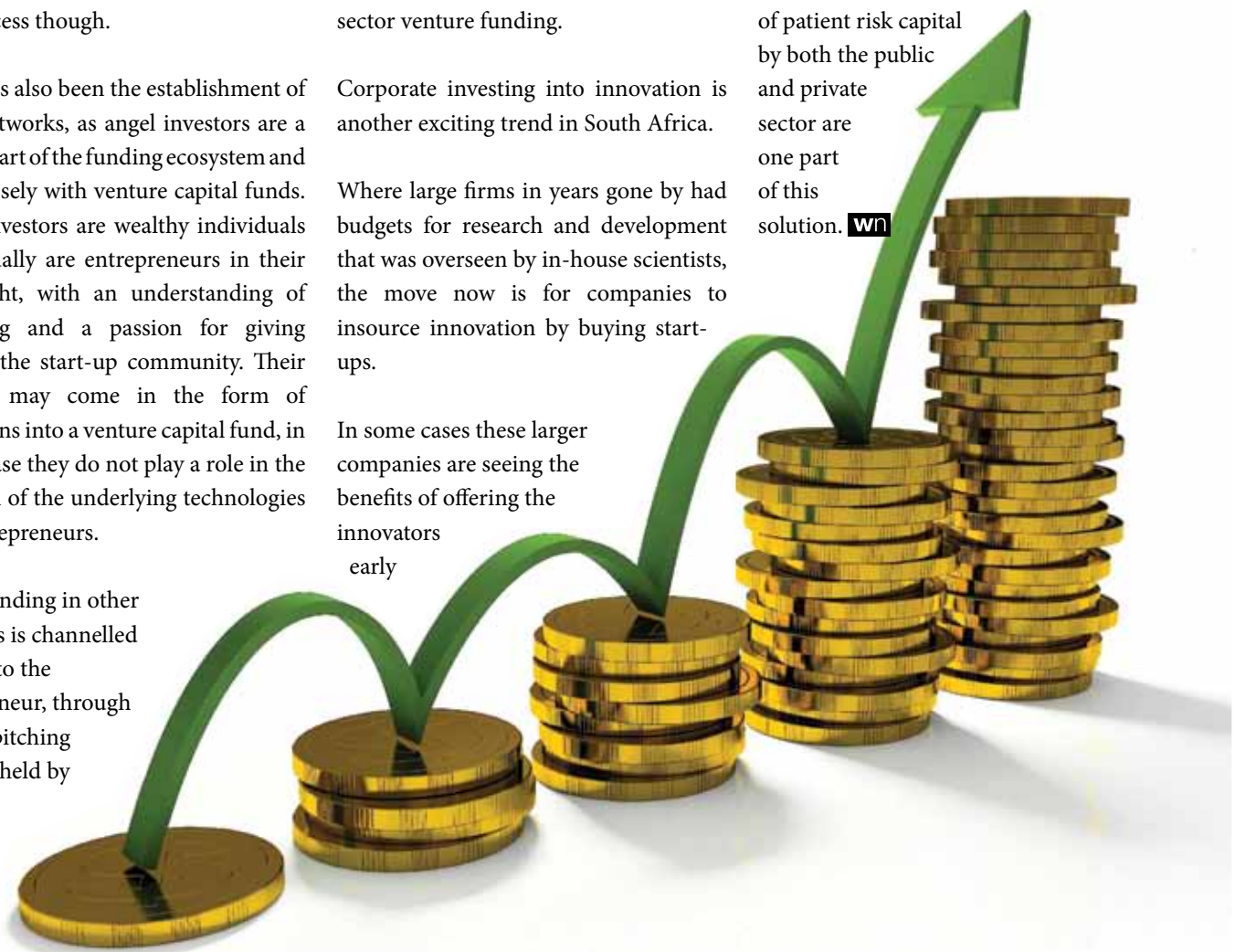
An amendment in recent years to the South African Income Tax Act has created a welcome inducement for individuals, trusts and companies to invest into innovation. Section 12J of the Act offers tax relief for allocations into qualifying and registered venture capital funds, and represents an important first step towards building a sensible and beneficial incentive structure for private sector venture funding.

Corporate investing into innovation is another exciting trend in South Africa.

Where large firms in years gone by had budgets for research and development that was overseen by in-house scientists, the move now is for companies to insource innovation by buying start-ups.

In some cases these larger companies are seeing the benefits of offering the innovators early stage business support services to increase the likely success of the commercialisation of the innovations.

Innovation takes time and by its nature is prone to uncertainty and risk. Boosting innovative activity in South Africa will require decisive implementation of wide-ranging support measures for creative thinking, business development, deepening of market networks and increased international collaboration. Carefully crafted funding options that embody the deployment of patient risk capital by both the public and private sector are one part of this solution. wn



A LIGHTER GREENER TOUCH

Lighting the way forward

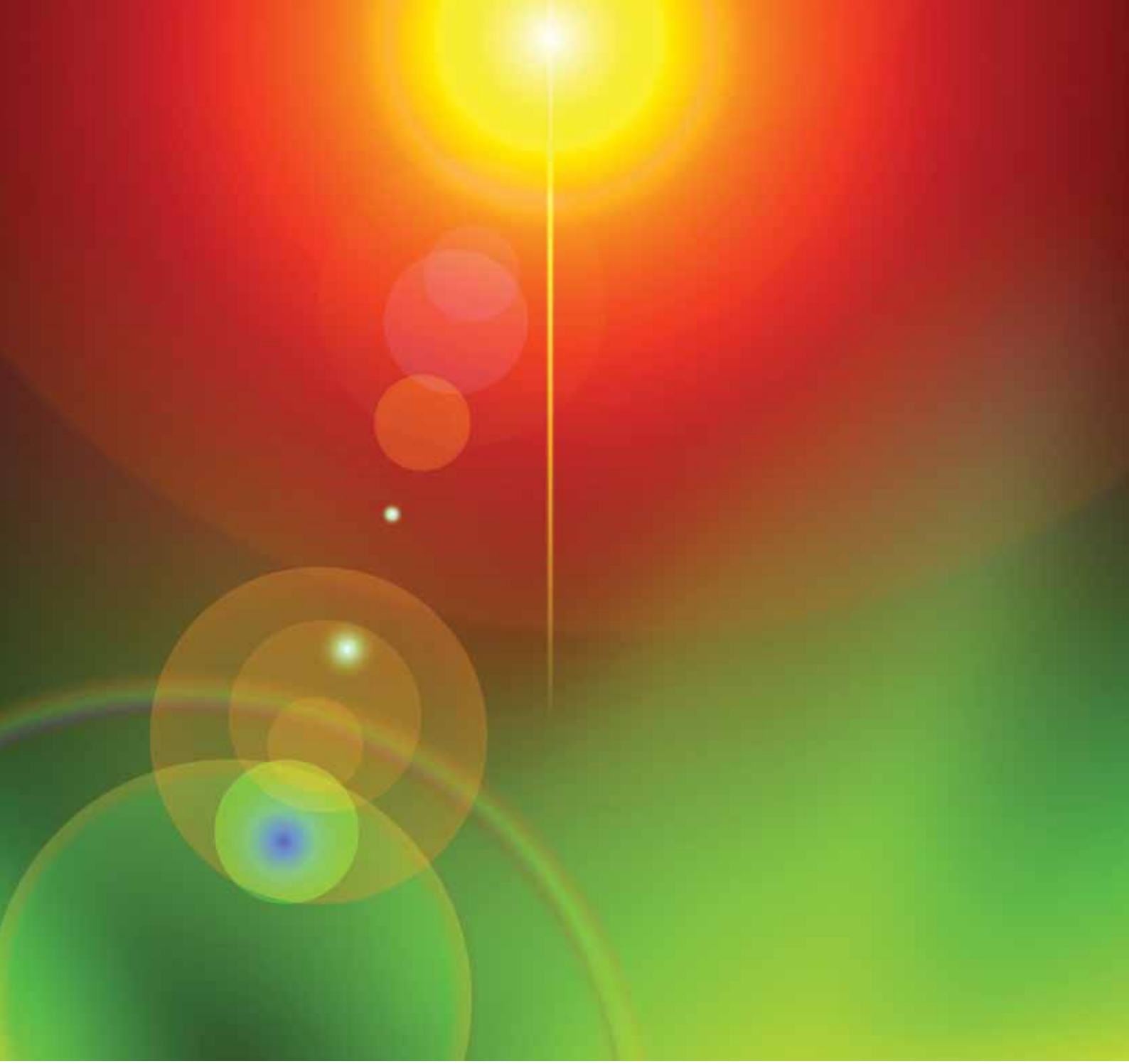
BY I MORAND FACHOT

The world's lighting industry is constantly expanding: driven by new lighting technologies, global population growth, increasing urbanization, rising incomes and a desire to check power consumption.

The lighting industry has a major global economic impact. It is very fragmented and complex and extends across three main sectors: general lighting, automotive lighting and backlighting (for broadcasting, IT and multimedia equipment). It was estimated to have revenues of around EUR 69 billion in 2010; these are expected to rise to EUR 108 billion in 2020, making this sector comparable in size to the global TV market.

General lighting accounts for close to 75% of the lighting market, according to a 2011 McKinsey report. It covers many components and elements, not just the most obvious categories of lamps and fixtures, but also, increasingly, lighting control and management systems. It is the fastest growing segment of the lighting market and is forecast to increase by 69% over the period 2010-2020.

The automotive lighting market is growing steadily as the vehicle market expands strongly in emerging countries and LED-based lights increase their penetration. It represents approximately 20% of the total lighting market.



General lighting consumes huge quantities of electricity, nearly a fifth of the total global production of electricity. At a time of growing concern regarding rising energy costs and environmental issues, efforts to curb electricity consumption have become a priority for governments around the world, making the lighting sector a prime target for savings. The quest for energy-efficient lighting has driven the development of new types of light sources in what has been a stable industry for a very long time

HOW LONG DOES IT TAKE TO CHANGE A LIGHT BULB…?

Lighting for residential, commercial and industrial use has relied on the incandescent light bulb for 130 years and also, from the 1930s onwards, on fluorescent tubes – the most common lamp in office lighting and many other commercial and industrial applications.

Incandescent bulbs are very inefficient as at most 5% of the power they consume is converted into visible light, while the rest is dissipated as heat. Fluorescent lights are more efficient, converting over 20% of the power input to visible white light.

In addition to being inefficient, incandescent light bulbs have a short rated lifespan of 750 to 1 000 hours. Fluorescent lights can last more than 15 000 hours. New types of lights that promise to deliver more energy-efficient lighting have emerged only fairly recently.

Lighting the way forward

continues from page 29

CONTAINING RISING POWER CONSUMPTION

Governments and businesses seeing the need to check rising energy consumption for economic, environmental and other reasons means that they have turned their attention to the main energy consumers to see where savings can be achieved. Lighting, because it uses a significant share of the world electrical energy, is an obvious choice.

Efforts to curb consumption of lighting installations have led governments to take measures to phase out incandescent lamps and support the introduction of more energy-efficient lamps. Decreasing production and retail costs of energy-efficient lights have also favoured their growing adoption by consumers in replacement of incandescent bulbs. They come in two main types: CFL (compact fluorescent lamp) and LED (light-emitting diode) lamps.

DIFFERENT TECHNOLOGIES, SAME PURPOSE

CFLs are based on the same principle as conventional fluorescent lamps but the tubes are folded or shaped into a spiral to provide compact size and allow them to fit in fixtures and luminaires designed for incandescent bulbs. They also use electronic ballasts: devices that limit the amount of current to ensure the light starts and operates properly. Ballasts for CFLs that are used in fixtures designed for incandescent lights are built into the base of the bulb.

CFLs are much more energy-efficient than incandescent lights. To provide an equivalent amount of visible light they use only around 75% of the energy an incandescent bulb would need. Another advantage of CFLs over incandescent bulbs is their longer rated service life, between 6 000 and 15 000 hours.

The other significant recent breakthrough in lighting has been the introduction of LED-based solutions (also called SSL, solid-state lighting). They have been described as a disruptive technology and "the only fundamentally new lamp technology to enjoy commercial success in the last 100 years". LED lamps rely on a semiconductor light source. LEDs were first used as components in electronic devices in the early 1960s. Their main use was as indicators and in displays where their low power consumption and long lifetime represented significant advantages. These characteristics also made them suitable for lighting applications.

LED lamps use up to a tenth of the energy needed by an incandescent bulb to give the equivalent amount of light. They have a very long service life: it can exceed 30 000 hours. Cutting maintenance costs drastically for many applications such as industrial, street, public or airfield lighting.

Initially their high cost limited their use to architectural, commercial and industrial environments, but falling prices mean they are now entering the residential market in significant volumes.

BENEFITS FAR OUTWEIGH DRAWBACKS

In spite of their significant advantages over incandescent bulbs, CFLs present certain shortcomings, but these are being addressed and they keep improving.

Many users complain that they do not give the same amount of light as incandescent bulbs. This is often the result of manufacturers making exaggerated claims based on the equivalent output in Watts of CFLs and incandescent bulbs and is also a result of their warmer colour temperature. Another criticism of CFLs is that, unlike their incandescent equivalents, they take longer to reach full brightness – up to a minute. While some CFLs are now "instantly on", not all are dimmable and their use in applications where they must be switched on and off frequently can shorten their service life significantly.

Environmental concerns have been expressed as CFLs, like all fluorescent lights, contain mercury. However, these claims are vastly exaggerated as the quantities of mercury in CFLs are minute: 3-5 mg per bulb with some eco-friendly categories containing as little as 1 mg. Countries that have introduced CFLs have also launched recycling schemes for the bulbs.

To put things in perspective, it is worth mentioning a 2008 study by Yale University which estimated that if the US switched to CFLs the energy savings at power stations would lead to cuts in mercury emissions of 25 000 tonnes a year. Furthermore, compared to an incandescent bulb, each CFL is expected to reduce CO_2 emissions by about 590 kg over its lifetime.

LEDING THE WAY INTO THE FUTURE

As for LED lamps, they are very energy efficient and flexible: they can be used in lighting management solutions with dimmers and sensors for commercial, industrial or public lighting solutions

and, increasingly, in homes. Their main drawback is their cost, which is still significantly higher than that of incandescent lamps or even CFLs as their production process is complex.

However, their price is predicted to drop by nearly 38% between 2012 and 2015, and a further 10-15% by 2020. Furthermore, given their extremely long lifetime they are an interesting solution.

Manufacturers' claims regarding the lifetime, lumen maintenance and chromaticity change of LED-based lights is often questioned given the expected duration of the tests (2-3 years).

However, results of a DoE (US Department of Energy) competition for 60 W LED replacement lights seems to vindicate these claims. Published in July 2013 they showed that after 25 000 hours of testing not a single of the 200 LED-based bulbs submitted by Philips Lighting North America had failed, and that all had exceeded the expected lumen maintenance and chromaticity change requirements set in the test.

There are constant improvements in the performance and efficiency of LED lights. Being relatively new products, their performance is often difficult to assess. To help with this problem, IEC SC 34A: Lamps, has issued several Publicly Available Specifications (PAS) covering the performance and measurement of lamps, luminaires and LED modules.

The use of PAS in this area has helped unify the way performance claims are being made by manufacturers and tests are being conducted to verify findings.

A MAJOR ECONOMIC STAKE AND A CLEANER SOLUTION

The ban on sales of incandescent lights in dozens of countries across the world, and their limited lifespan, mean that a huge market for replacement energy-efficient bulbs has emerged.

The global market for lamps alone is forecast to reach USD 40,4 billion by 2017, according to a November 2011 GIA (Global Industry Analysts) report.

The latest Country Lighting Assessments for 150 countries released by the United Nations Environment Programme (UNEP) and its partners in June 2012 gives details of the economic and environmental benefits of a switch to energy-efficient lights.

The yearly savings in electricity for a global phase-out of inefficient lights would amount to around 5% of global electricity consumption. The construction of 252 large power plants (500 MW each) could be avoided, resulting in savings on unnecessary investments of approximately USD 210 billion. Additionally, 490 million tonnes of CO_2 emissions a year would be prevented.

The work done by TC 34 and its SCs in preparing International Standards regarding specifications for lamps, luminaires and all related equipment has been instrumental in helping the industry introduce reliable energy-efficient lights and in bringing countless economic, energy and environmental benefits to the world. wn

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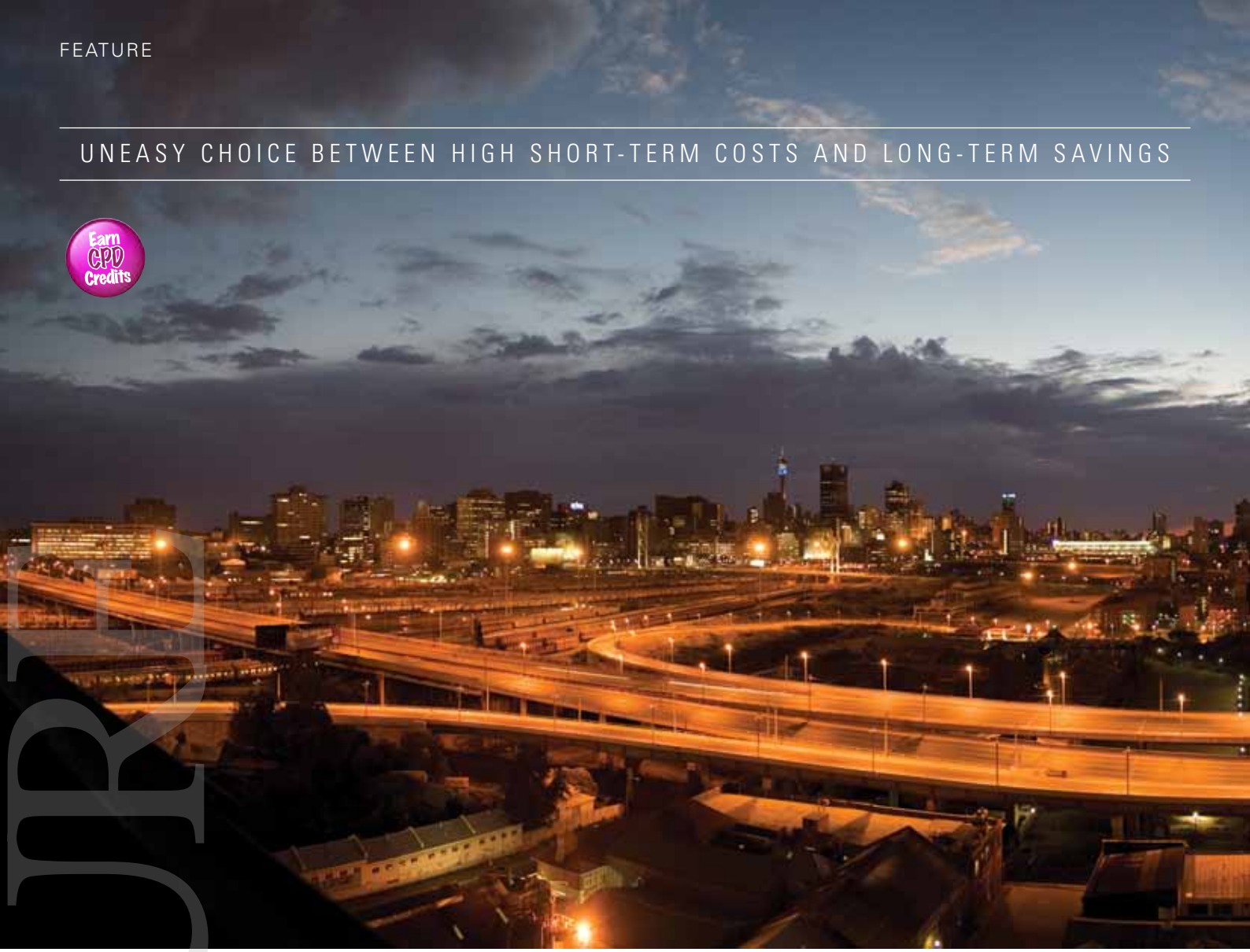
UNEASY CHOICE BETWEEN HIGH SHORT-TERM COSTS AND LONG-TERM SAVINGS



Urban Lighting: upgrade or replace?

BY I MORAND FACHOT

Lighting for the residential, commercial, industrial and public spaces is undergoing a radical transformation with the introduction of new lighting solutions.

Users are often faced with an alternative: buying new systems, upgrading or adapting existing installations.

Until the emergence of entirely new types of energy-efficient lighting systems and public policies aimed at cutting the growth in energy consumption, homeowners, businesses or public authorities had little choice but to rely on long-standing and tested solutions.

Homes mainly used very inefficient incandescent bulbs, of the tungsten or halogen sorts. They are now shifting to more energy-efficient CFLs (compact fluorescent lamps) or LED lamps as incandescent bulbs are being phased out.

In office, commercial, industrial or public spaces fluorescent tubes, incandescent bulbs and HID (high intensity discharge) lamps are used, as well as other light sources such as incandescent, halogen or CFLs for task lighting.

HID lamps are also used in warehouses, outdoor areas, parking lots, pathways, etc. Public institutions also manage extensive lighting assets for outdoor use.

These are large consumers of electricity and many authorities are looking at ways of cutting their energy and life-cycle maintenance bills. The choice they face is between refurbishing, renewing or replacing parts of, or whole installations, with the decision down to costs, and sometimes taken according to short-term constraints rather than long-term considerations.

STREET AND CITY LIGHTING – A POWER-HUNGRY ENVIRONMENT

In addition to operating lighting installations for offices, buildings for emergency services or indoor sports

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facilities, public institutions have to manage extensive and complex urban lighting networks and equipment. These are necessary for city and street lighting, traffic lights and signage for roads, bridges and tunnels, as well as for public spaces.

The resulting operating costs for the energy consumed, servicing and maintenance of urban lighting installations may represent a significant burden in the long term and authorities everywhere are looking at ways of cutting these.

Operating costs, rather than initial capital costs, are often the deciding factor in the refurbishing, upgrading or replacement of lighting assets.

As regards office space or other premises the replacement or upgrade of energy-inefficient lights can be adopted to cut energy bills. The same easy solution does not apply to urban lighting which is a demanding and power-hungry environment. In the US, for instance, Lighting consumes 8% of all the energy generated in the country.

Urban lighting is complex as it must meet many needs such as helping pedestrians and road users find their bearings and move around safely, illuminate architectural landmarks or outdoor areas, such as parks or sports grounds, provide light at entrances and all around buildings, etc. To fulfil these needs different types of fixtures are needed, such as recessed or low and high column or catenary luminaires for orientation or road lighting, spots or floodlights to illuminate facades, wall luminaires, traffic lights, etc.

As public institutions in many countries are looking at meeting sustainability targets and at providing the proper level of services expected by local residents with more limited resources, street lighting installations, that may account for as much as 40% of their electricity bill are seen as opening possibilities for long-term savings and good returns on investments. LED-based lighting solutions in particular offer radically new prospects not just by saving operating costs, but also as they may transform completely public outdoor lighting by introducing tailor-made and smart solutions.

SMART LIGHTING FOR SMART CITIES

Outdoor urban lighting for streets, paths, and other applications still uses mainly HID lamps like low and high pressure sodium vapour lamps and metal halide lamps. These lamps present the advantages of having long service lives when properly powered and high luminous efficacy, but present a number of shortcomings in terms of light quality, power consumption and flexibility.

Low and high pressure sodium vapour lamps have poor colour rendering as they appear bright yellow or intense pink orange when warm. Metal halide lamps provide a whiter light and are used for wide area overhead lighting of commercial, industrial and public spaces.

However HID lamps cannot be dimmed and may see their service life more than halved if switched on and off frequently. A number of cities and local authorities are looking at phasing out these lamps and replacing them with LED-based solutions. Key drivers for the change are the dramatic fall in the price of LED lamps, public policies pushing energy efficiency and investments in smart city infrastructure that will integrate smart street lighting systems.

Smart street lighting systems are equipped with control nodes that, in combination with various sensors, allow for the remote on/off switching and some level of dimming control.

IEC SC 47E: Discrete semiconductor devices, prepares International Standards for components used in a variety of sensors.

As for IEC SC 23B: Plugs, socket-outlets and switches, it prepares International Standards for home and building electronic systems (HBES) switches that can be used for the operation of lamp circuits and dimmers. Pike Research, a market research and consulting company that provides analysis of global clean technology markets, estimates that more than USD 100 billion will be spent in the next 10 years to support smart city development and that "the power and communications ability of a smart street lighting system can provide the backbone for many smart street applications".

The company forecasts unit sales of LED street lights to grow by 24,9% a year between 2012 and 2020, from fewer than 3 million to more than 17 million units.

BALANCING TIGHT BUDGETS AND SAVING NEEDS

A number of initiatives, at a city level or grouping several urban communities, sometimes in different countries, are looking at the opportunities and costs of introducing LED street lighting and smart lighting projects.

The US city of Pittsburgh, Pennsylvania, published its LED Street Light Research Project report in September 2011. The city operates some 40 000 street lights at a yearly electricity and maintenance cost of approximately USD 4,2 million.

Replacing these mainly HID lights fixtures with LED systems is expected to save an estimated USD 1,7 million a year in reduced energy and maintenance costs and to cut CO_2 (carbon dioxide) emissions by 6 818 tonnes a year.

However, following a pilot project it appears that switching from the current system to the more advanced LED lights, even if smart solutions are not introduced, is a complex procedure. Unlike luminaires found in households and many offices, which allows CFLs or LED lamps to replace incandescent light bulbs, LED systems cannot be installed in existing street fixtures designed for HID lights, as they require electronics and ballasts of a different kind.

Furthermore, luminaires for current lamps do not have reflectors or lenses that can control glare from LED lamps or provide the right beams and must be replaced. Therefore, the whole conversion appears quite costly.

However, an important factor to be taken into account is the extremely long life of LED-based street lighting solutions. Certain street lights have a lifetime of 60 000 hours, equivalent to being on 12 hours a day for over 13 years without dimming. Reduced maintenance, replacement and power costs make LED street lights attractive solutions in the longer term. The choice between high short-term capital expenditures and long-term maintenance, operating and energy savings may not be an easy one for many public institutions that manage very large urban lighting assets as they also try to keep their budget under control. Whether the introduction of energy-efficient and smart lighting appears sooner or later, the IEC's work will ensure its components will be as interchangeable and as safe to operate as possible. wn

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FEATURE

CAR MANUFACTURERS ARE INTRODUCING LED-BASED LIGHTS IN ALL

Although traffic on the roads is reduced at night, in many countries, including the US, around 40% or more of all traffic fatalities occur during night-time hours. Well-lit roads ease drivers' strain and greatly increase safety. The recent introduction of LED-based lamps (also called SSL, solid-state lighting) for autos is set to improve driver safety and comfort at night, as well as during the day, and to offer additional advantages in cabin lighting. IEC International Standards will play a key role in the move to SSL in automotive lighting, a market whose total value is forecast to grow from nearly 19,5 billion in 2013 to more than USD 25,3 billion by 2018. The need for drivers to see other vehicles - and to be seen by them - after dark emerged naturally as soon as cars first appeared on roads. Initially, cars were fitted with acetylene and oil lamps.

Early car electrical systems were rather unstable and their lamps were subjected to harsh conditions such as shock and widely varying climatic conditions and temperatures. All of these contributed to the somewhat slow large-scale implementation of electric lamps, which only started in the 1920s.

CLASSES OF VEHICLES

Bright future for LEDs on the road

BY I MORAND FACHOT

The majority of drivers feel stressed in poor visibility conditions, particularly at night when the ability to perceive and judge distance is severely impaired.

SLOW INITIAL PROGRESS, BUT RAPID EXPANSION NOW

Because the ability to see ahead properly is fundamental to safe night driving, improving the performance of headlamp light bulbs has always been seen as essential.

Until the introduction of High-Intensity Discharge (HID) lamps, also known as Xenon lamps, the light source used in incandescent headlamps was a tungsten filament placed in a vacuum or inert-gas atmosphere inside a bulb or a sealed unit. The main drawback of tungsten bulbs is that their luminous flux (intensity) drops significantly after some 1 000 hours. The tungsten bulbs were further improved with the introduction of halogen gas in the bulbs in the early 1960s. Halogen bulbs had a higher luminous flux and longer useful lifetime.

Xenon lamps that generate light based on the principle of gas discharge were first fitted to motor vehicles in the early 1990s. They represented a major improvement over halogen lamps as their colour temperature is closer to daylight, they are brighter, they have a greater range, they illuminate the edges of the road better and they last at least twice as long. The main drawback to Xenon is glare, which can be reduced by the incorporation of various automatic devices. In spite of their qualities, xenon lamps are not as widely adopted as halogen lamps.

LEDS ENTER THE AUTOMOTIVE WORLD

The introduction of LED-based automotive lighting is a relatively recent development. The first LED rear lights and headlamps were fitted to production vehicles in 2003

Bright future for LEDs on the road

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and 2006, respectively. The benefits of LEDs, especially for headlamps, are already obvious, including the fact that their light colour is very similar to daylight. LED headlamps are now being introduced by all major car manufacturers and are seen as the future of automotive lighting.

Besides headlamps, LED-based lights can be used for general and interior lighting. Their higher energy efficiency translates into lower fuel consumption and noxious emissions, helping manufacturers meet ever more stringent regional or national limits. LED light sources have a much longer lifetime than their predecessors; they may even outlast the vehicle to which they are fitted. They also offer an unprecedented level of design versatility that is essential for manufacturers, allowing them to differentiate their vehicles from the competition.

INTERNATIONAL REGULATIONS AND STANDARDS

Road vehicles are produced and traded globally and are used regularly across national borders. The need for International Standards is clear as road safety requires that lights are standardized in terms of characteristics such as performance, colour durability and interchangeability.

The UN Economic Commission for Europe; www.unece.org (UNECE) is the international body that sets many of the regulations for road vehicles through its World Forum for Harmonization of Vehicle Regulations (WP 29).

The UNECE Working Party on Lighting and Light-Signalling (GRE) is the subsidiary body that prepares regulatory proposals on active safety for vehicle lighting and light signalling. This group conducts research and analysis to develop lighting requirements for vehicles. Most countries — with the notable exception of the US and Canada, which have their own directives — recognize the UNECE Regulations and apply them in their own national requirements. Much of the GRE's work depends on and references various International Standards on lighting for road vehicles prepared by the IEC.

EVOLVING STANDARDS

The relatively recent introduction of LED-based light sources has led to changes in lighting standards. Initially fitted to the high-end/luxury segment of the car market, LED lights are spreading rapidly to all categories of vehicles due to their wide-ranging benefits and flexibility. As these lights represent a completely new concept, they require new standards to ensure they meet road safety regulations and operate properly in a highly demanding environment.

IEC Subcommittee (SC) 34A: Lamps prepares International Standards for all types of lamps (filament, discharge and LED), for general lighting and for road vehicles. These Standards identify the lamps' dimensional, electrical, luminous and performance requirements. Lamps for road vehicles operate in a particularly harsh environment and since they have a direct impact on road safety, tests are essential to ensure they meet all the necessary conditions.

DIFFERING CONSTRAINTS

The basic function and interchangeability of filament and discharge lamps for road vehicles differ from those of LED light sources. The former types must comply with the IEC 60809 International Standard that defines the dimensional, electrical and luminous requirements of lamps for road vehicles. In particular, this standard defines the markings, bulbs, dimensions, colours, caps and bases.

LED light sources, which are based on modules (LED components used by the industry), are not covered by IEC 60809 but by other IEC Standards specific to LED modules.

However, the latest edition (released in February 2013) of another International Standard, IEC 60810, which sets out the performance requirements of lamps for road vehicles, applies to all 3 types of lamps.

SPECIAL CONDITIONS

LED light sources must meet conditions that are not necessarily relevant to filament and discharge lamps, in terms of UV radiation, colour maintenance and electromagnetic compatibility. As LED light sources have a longer rated lifetime than filament or discharge lamps, their lumen maintenance is assessed differently.

Another issue that manufacturers have had to deal with is thermal management, and LED modules and light sources often come with integrated heat sinks. Unlike their filament and discharge counterparts, LED light sources are mainly of the non-replaceable type and are usually intended as components for integration into the luminaire or lighting device by manufacturers.

They are designed as, and meant to be, indivisible parts of a lighting or light signalling device, or to be elements of a module or light engine. The auto industry

has developed replaceable LED modular sources, usually intended for sale to the general public as replacement parts.

UNPARALLELED FLEXIBILITY AND BENEFITS

LED light sources can replace all other types of automotive lamps. They are available for headlamps (high and low beam), brake lights, rear combination lamps, centre high-mount stop lamps, daytime running lamps (DRLs), indicators, interior reading lights (map lights), dome lights, accent lights, fog lamps and position and marker lamps. Moreover, LEDs are being used for ambient lighting and in dashboard and instrument lighting.

In addition to enhanced driving safety and comfort, LED light sources offer many other benefits:

- Lighting flexibility: lighting requirements and limitations vary greatly according to traffic conditions. LED solutions allow the optimal use of environmental and traffic-related dynamically controllable light distribution patterns such as dynamic bending of light or adaptive front lighting systems (AFSs), already used for other types of automotive lamps. Such adaptive lighting is particularly important to avoid blinding other drivers when turning across or following other vehicles, or for better visibility of fixed or moving obstacles on road sides. LED lights are also dimmable

- Durability and efficiency: LEDs for automotive lighting have a much longer rated lifetime and use less energy than filament or discharge lamps. LEDs are up to 40% more energy efficient than the former sources. Since reduced energy for lighting translates into lower fuel consumption, this is a significant feature at a time when tighter consumption and emission rules are introduced in all countries, even though road vehicles are required now to use DRLs in many countries

- Design flexibility: an important benefit of LED lighting solutions for car manufacturers is the design flexibility they offer. Car design bureaus have much greater freedom to come up with innovative designs using lighting to accentuate or attenuate certain shapes and give cars a common brand signature. LEDs were first fitted to vehicles from the exclusive segment of the market, but they are now found in all classes of cars.

POTENTIAL NOT EXHAUSTED

LEDs for automotive or other applications are constantly evolving. Their potential in the automotive sector is set to expand as LED modules improve and as new technologies like OLEDs (organic LEDs), which produce a comfortable and homogenous light, are introduced. Safer night driving conditions do not depend on good vehicle lighting alone but also on superior road signage and lighting. LEDs are also increasingly showing the way in this highly significant area. Further benefits of LED lighting for automotive applications are likely to be discovered and it can be safely assumed that they will have a bright future in the road traffic environment. wn

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The internet that wasn't

HOW TCP/IP ECLIPSED THE OPEN SYSTEMS INTERCONNECTION STANDARDS TO BECOME THE GLOBAL PROTOCOL FOR COMPUTER NETWORKING

If everything had gone according to plan, the Internet as we know it would never have sprung up. That plan, devised 35 years ago, instead would have created a comprehensive set of standards for computer networks called Open Systems Interconnection, or OSI.

BY | ANDREW L RUSSELL

Its architects were a dedicated group of computer industry representatives in the United Kingdom, France, and the United States who envisioned a complete, open, and multilayered system that would allow users all over the world to exchange data easily and thereby unleash new possibilities for collaboration and commerce.

For a time, their vision seemed like the right one. Thousands of engineers and policy-makers around the world became involved in the effort to establish OSI standards. They soon had the support of everyone who mattered: computer companies, telephone companies, regulators, national governments, international standards setting agencies, academic researchers, even the U.S. Department of Defense. By the mid-1980s the worldwide adoption of OSI appeared inevitable.

And yet, by the early 1990s, the project had all but stalled in the face of a cheap and agile, if less comprehensive, alternative: the Internet's Transmission Control Protocol and Internet Protocol. As OSI faltered, one of the Internet's chief advocates, Einar Stefferud, gleefully pronounced: *"OSI is a beautiful dream, and TCP/IP is living it!"*

What happened to the "beautiful dream"? While the Internet's triumphant story has been well documented by its designers and the historians they have worked with, OSI has been forgotten by all but a handful of veterans of the Internet-OSI standards wars. To understand why, we need to dive into the early history of computer networking, a time when the vexing problems of digital convergence and global interconnection were very much on the minds of computer scientists, telecom engineers, policymakers, and industry executives. And to appreciate that history, you'll have to set aside for a few minutes what you already know about the Internet. Try to imagine, if you can, that the Internet never existed.

The story starts in the 1960s. The Berlin Wall was going up. The Free Speech movement was blossoming in Berkeley. U.S. troops were fighting in Vietnam. And digital computer-communication systems were in their infancy and the subject of intense, wide-ranging investigations, with dozens (and soon hundreds) of people in academia, industry, and government pursuing major research programs.

The most promising of these involved a new approach to data communication called packet switching. Invented independently by Paul Baran at the Rand Corp. in the United States and Donald Davies at the National Physical Laboratory in England, packet switching broke messages into discrete blocks, or packets, that could be routed separately across a network's various channels. A computer at the receiving end would reassemble the packets into their original form. Baran and Davies both believed that packet switching could be more robust and efficient than circuit switching, the old technology used in telephone systems that required a dedicated channel for each conversation.

Researchers sponsored by the U.S. Department of Defense's Advanced Research Projects Agency created the first packet-switched network, called the ARPANET, in 1969. Soon other institutions, most notably the computer giant IBM and several of the telephone monopolies in Europe, hatched their own ambitious plans for packet-switched networks. Even as these institutions contemplated the digital convergence of computing and communications, however, they were anxious to protect the revenues generated by their existing businesses. As a result, IBM and the telephone monopolies favored packet switching that relied on *"virtual circuits"*—a design that mimicked circuit switching's technical and organizational routines.

With so many interested parties putting forth ideas, there was widespread agreement that some form of international standardization would be necessary for packet switching to be viable. An early attempt began in 1972, with the formation of the International Network Working Group (INWG). Vint Cerf was its first chairman; other active members included Alex McKenzie in the United States, Donald Davies and Roger Scantlebury in England, and Louis Pouzin and Hubert Zimmermann in France.

The purpose of INWG was to promote the *"datagram"* style of packet switching that Pouzin had designed. As he explained to me when we met in Paris in 2012, *"The essence of datagram is connectionless. That means you have no relationship established between sender and receiver. Things just go separately, one by one, like photons."* It was a radical proposal, especially when compared to the connection-oriented virtual circuits favored by IBM and the telecom engineers.

INWG met regularly and exchanged technical papers in an effort to reconcile its designs for datagram networks, in particular for a transport protocol—the key mechanism for exchanging packets across different types of networks. After several years of debate and discussion, the group finally reached an agreement in 1975, and Cerf and Pouzin submitted their protocol to the international body responsible for overseeing telecommunication standards, the International Telegraph and Telephone Consultative Committee (known by its French acronym, CCITT).

The committee, dominated by telecom engineers, rejected the INWG's proposal as too risky and untested. Cerf and his colleagues were bitterly disappointed. Pouzin, the combative leader of Cyclades, France's own packet-switching research project, sarcastically noted that members of the CCITT *"do not object to packet switching, as long as it looks just like circuit switching."* When Pouzin complained at major conferences about the *"arm-twisting"* tactics of *"national monopolies,"* everyone knew he was referring to the French telecom authority. French bureaucrats did not appreciate their countryman's candor, and government funding was drained from Cyclades between 1975 and 1978, when Pouzin's involvement also ended.

For his part, Cerf was so discouraged by his international adventures in standards making that he resigned his position as INWG chair in late 1975. He also quit the faculty at Stanford and accepted an offer to work with Bob Kahn at ARPA. Cerf and Kahn had already drawn on Pouzin's datagram design and published the details of their *"transmission control program"* the previous year in the IEEE Transactions on Communications. That provided the technical foundation of the *"Internet"*, a term adopted later to refer to a network of networks that utilized ARPA's TCP/IP. In subsequent years the two men directed the development of Internet protocols in an environment they could control: the small community of ARPA contractors.

Cerf's departure marked a rift within the INWG. While Cerf and other ARPA contractors eventually formed the core of the Internet community in the 1980s, many of the remaining veterans of INWG regrouped and joined the international alliance taking shape under the banner of OSI. The two camps became bitter rivals.

In 1977, representatives from the British computer industry proposed the creation of a new standards committee devoted to packet-switching networks within the International Organization for Standardization (ISO), an independent nongovernmental association created after World War II. Unlike the CCITT, ISO wasn't specifically concerned with telecommunications - the wide-ranging topics of its technical committees included TC 1 for standards on screw threads and TC 17 for steel. Also unlike the CCITT, ISO already had committees for computer standards and seemed far more likely to be receptive to connectionless datagrams.

The British proposal, which had the support of U.S. and French representatives, called for *"network standards needed for open working."* These standards would, the British argued, provide an alternative to traditional computing's *"self-contained, 'closed' systems,"* which were designed with *"little regard for the possibility of their interworking with each other."* The concept of open working was as much strategic as it was technical, signaling their desire to enable competition with the big incumbents - namely, IBM and the telecom monopolies.

As expected, ISO approved the British request and named the U.S. database expert Charles Bachman as committee chairman. Widely respected in computer circles, Bachman had four years earlier received the prestigious Turing Award for his work on a database management system called the Integrated Data Store.

The layered OSI reference model provided an important organizational feature: modularity. That is, the layering allowed committees to subdivide the work. Indeed, Bachman's reference model was just a starting point. To become an international standard, each proposal would have to

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complete a four-step process, starting with a working draft, then a draft proposed international standard, then a draft international standard, and finally an international standard. Building consensus around the OSI reference model and associated standards required an extraordinary number of plenary and committee meetings.

OSI's first plenary meeting lasted three days, from 28 February through 2 March 1978. Dozens of delegates from 10 countries participated, as well as observers from four international organizations. Everyone who attended had market interests to protect and pet projects to advance. Delegates from the same country often had divergent agendas. Many attendees were veterans of INWG who retained a wary optimism that the future of data networking could be wrested from the hands of IBM and the telecom monopolies, which had clear intentions of dominating this emerging market.

Meanwhile, IBM representatives, led by the company's capable director of standards, Joseph De Blasi, masterfully steered the discussion, keeping OSI's development in line with IBM's own business interests. Computer scientist John Day, who designed protocols for the ARPANET, was a key member of the U.S. delegation. In his 2008 book Patterns in Network Architecture (Prentice Hall), Day recalled that IBM representatives expertly intervened in disputes between delegates *"fighting over who would get a piece of the pie.… IBM played them like a violin. It was truly magical to watch."*

Despite such stalling tactics, Bachman's leadership propelled OSI along the precarious path from vision to reality. Bachman and Hubert Zimmermann (a veteran of Cyclades and INWG) forged an alliance with the telecom engineers in CCITT. But the partnership struggled to overcome the fundamental incompatibility between their respective worldviews. Zimmermann and his computing colleagues, inspired by Pouzin's datagram design, championed *"connectionless"* protocols, while the telecom professionals persisted with their virtual circuits. Instead of resolving the dispute, they agreed to include options for both designs within OSI, thus increasing its size and complexity.

This uneasy alliance of computer and telecom engineers published the OSI reference model as an international standard in 1984. Individual OSI standards for transport protocols, electronic mail, electronic directories, network management, and many other functions soon followed. OSI began to accumulate the trappings of inevitability. Leading computer companies such as Digital Equipment Corp., Honeywell, and IBM were by then heavily invested in OSI, as was the European Economic Community and national governments throughout Europe, North America, and Asia.

Even the U.S. government - the main sponsor of the Internet protocols, which were incompatible with OSI - jumped on the OSI bandwagon. The Defense Department officially embraced the conclusions of a 1985 National Research Council recommendation to transition away from TCP/IP and toward OSI. Meanwhile, the Department of Commerce issued a mandate in 1988 that the OSI standard be used in all computers purchased by U.S. government agencies after August 1990.
While such edicts may sound like the work of overreaching bureaucrats, remember that throughout the 1980s, the Internet was still a research network: It was growing rapidly, to be sure, but its managers did not allow commercial traffic or for-profit service providers on the government-subsidized backbone until 1992. For businesses and other large entities that wanted to exchange data between different kinds of computers or different types of networks, OSI was the only game in town.

That was not the end of the story, of course.

By the late 1980s, frustration with OSI's slow development had reached a boiling point. At a 1989 meeting in Europe, the OSI advocate Brian Carpenter gave a talk titled *"Is OSI Too Late?"* It was, he recalled in a recent memoir, *"the only time in my life"* that he *"got a standing ovation in a technical conference."*

Two years later, the French networking expert and former INWG member Pouzin, in an essay titled *"Ten Years of OSI - Maturity or Infancy?,"* summed up the growing uncertainty: *"Government and corporate policies never fail to recommend OSI as the solution. But, it is easier and quicker to implement homogenous networks based on proprietary architectures, or else to interconnect heterogeneous systems with TCP-based products."* Even for OSI's champions, the Internet was looking increasingly attractive.

That sense of doom deepened, progress stalled, and in the mid-1990s, OSI's beautiful dream finally ended. The effort's fatal flaw, ironically, grew from its commitment to openness. The formal rules for international standardization gave any interested party the right to participate

in the design process, thereby inviting structural tensions, incompatible visions, and disruptive tactics.

OSI's first chairman, Bachman, had anticipated such problems from the start. In a conference talk in 1978, he worried about OSI's chances of success: *"The organizational problem alone is incredible. The technical problem is bigger than any one previously faced in information systems and the political problems will challenge the most astute statesmen. Can you imagine trying to get the representatives from ten major and competing computer corporations, and ten telephone companies and PTTs [state-owned telecom monopolies], and the technical experts from ten different nations to come to any agreement within the foreseeable future?"*

Despite Bachman's and others' best efforts, the burden of organizational overhead never lifted. Hundreds of engineers attended the meetings of OSI's various committees and working groups, and the bureaucratic procedures used to structure the discussions didn't allow for the speedy production of standards.

Meanwhile, the Internet flourished. With ample funding from the U.S. government, Cerf, Kahn, and their colleagues were shielded from the forces of international politics and economics. ARPA and the Defense Communications Agency accelerated the Internet's adoption in the early 1980s, when they subsidized researchers to implement Internet protocols in popular operating systems, such as the modification of Unix by the University of California, Berkeley. Then, on 1 January 1983, ARPA stopped supporting the ARPANET host protocol, thus forcing its contractors to adopt TCP/IP if they wanted to stay connected; that date became known as the *"birth of the Internet."*

And so, while many users still expected OSI to become the future solution to global network interconnection, growing numbers began using TCP/IP to meet the practical near-term pressures for interoperability.

Engineers who joined the Internet community in the 1980s frequently misconstrued OSI, lampooning it as a misguided monstrosity created by clueless European bureaucrats. Internet engineer Marshall Rose wrote in his 1990 textbook that the *"Internet community tries its very best to ignore the OSI community. By and large, OSI technology is ugly in comparison to Internet technology."*

Although Cerf and Kahn did not design TCP/IP for business use, decades of government subsidies for their research eventually created a distinct commercial advantage: Internet protocols could be implemented for free.

By the mid-1990s, the Internet had become the de facto standard for global computer networking. Cruelly for OSI's creators, Internet advocates seized the mantle of *"openness"* and claimed it as their own. Today, they routinely campaign to preserve the "open Internet" from authoritarian governments, regulators, and would-be monopolists.

In light of the success of the nimble Internet, OSI is often portrayed as a cautionary tale of overbureaucratized *"anticipatory standardization"* in an immature and volatile market. This emphasis on its failings, however, misses OSI's many successes: It focused attention on cutting-edge technological questions, and it became a source of learning by doing - including some hard knocks - for a generation of network engineers, who went on to create new companies, advise governments, and teach in universities around the world.

Beyond these simplistic declarations of *"success"* and *"failure,"* OSI's history holds important lessons that engineers, policymakers, and Internet users should get to know better. Perhaps the most important lesson is that "openness" is full of contradictions. OSI brought to light the deep incompatibility between idealistic visions of openness and the political and economic realities of the international networking industry. wn

The challenges of a smart grid

The smart grid combines ICT and leading edge intelligence capabilities with existing electrical infrastructure to deliver real-time energy information and knowledge. It empowers smarter energy choices, and has the potential to transform the energy business and use of electric power throughout the world.

BY | BRADLEY HEMPHILL | PR.ENG | B.SC(ENG)

It can without a doubt help support energy needs, significantly enhance electricity distribution, and generally create a more comfortable future.

The smart grid helps overcome the shortcomings of the existing power grid which are:

- the need for greater grid reliability, security and efficiency;
- the need for environmental and energy sustainability;
- and the need to empower consumers to manage their energy usage.

Clearly the smart grid offers numerous benefits. However, implementing the correct technical processes and leveraging the necessary skills to enable a smart grid, come with their own set of challenges.

The challenges can be closely likened to a classic management problem: Management needs a set of competencies, coupled to a set of processes and the application of the correct human behaviour. In a smart

grid, competency can take the form of technology; process takes the form of our regulatory environment; and human behaviour equates to people.

TECHNOLOGY

Technology is what is available to enable the smart grid strategy or process. Smart grid automation technologies, such as energy management systems and distribution management systems, are required to help provide real-time knowledge and control over the distribution and transmission grid.

The good news is that most of the technologies or components making up the grid already exist. However technology alone will not create a smart grid. The interoperability between the technical components needs urgent attention.

REGULATORY ENVIRONMENT

In addition to technologies, we need a regulatory environment to allow a smart grid to exist. The smart grid is a young market, and as a whole the regulatory environment is still in its early days and

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therefore needs to be developed more. National Energy Regulator of South Africa (NERSA) legislation, or the equivalent energy regulator in other countries, needs to be changed and updated to adapt to this new market.

PEOPLE

People, the most important element in the mix, need to change their behaviour and the way they think. We need like-minded people to engage and work together in conjunction with the national regulator, NERSA, to achieve a common technical and regulatory goal. People implement technologies, and without the right people speaking to one another or sharing the same common goal, the smart grid will not be achieved.

So where does ICT come into play?

THE TWO KEY AREAS, AMONGST MANY OTHERS, ARE:

AUTOMATED DEMAND RESPONSE

The typical use of Automated Demand Response is to send information and signals to cause electrical power-using devices to be turned off during periods of high demand.

In electricity grids, Demand Response is a dynamic demand mechanism used to manage customer consumption of electricity in response to supply conditions. An example is having electricity customers reduce their consumption at critical times or in response to market prices.

It is becoming integrated into a dazzling array of technologies, from appliances to building management systems, blurring the line between energy management, demand response and ancillary services.

CLOUD COMPUTING

Cloud Computing is a technology enabler. It is the use of a network of remote servers hosted on the Internet to store, manage and process data. It offers previously unimaginable computing power, storage, connectivity, and other abilities that can be harnessed and leveraged in the creation of energy management systems.

Most applications, with the exception of real-time control, are suitable for the cloud. Some examples of smart grid applications that are today being moved to the cloud are:

- Storing, processing and accessing data collected from multiple homes
- Connectivity to end users
- Cloud-to-cloud integration
- Home monitoring and security
- A platform for applications to access data that can be further analysed

IT IS ALL ABOUT COLLABORATION

We need to combine technology, the regulatory environment and people, and collaborate to achieve this smart grid. Integral to this is having the right conversations, with the right people. We will not be replacing the existing grid, so it is necessary to start with existing systems and then progressively link them together by utilising ICT enabling technologies and intelligence capabilities.

It is only in doing this that we will be able to empower smarter energy choices, help support energy needs, and significantly enhance electricity distribution. wn

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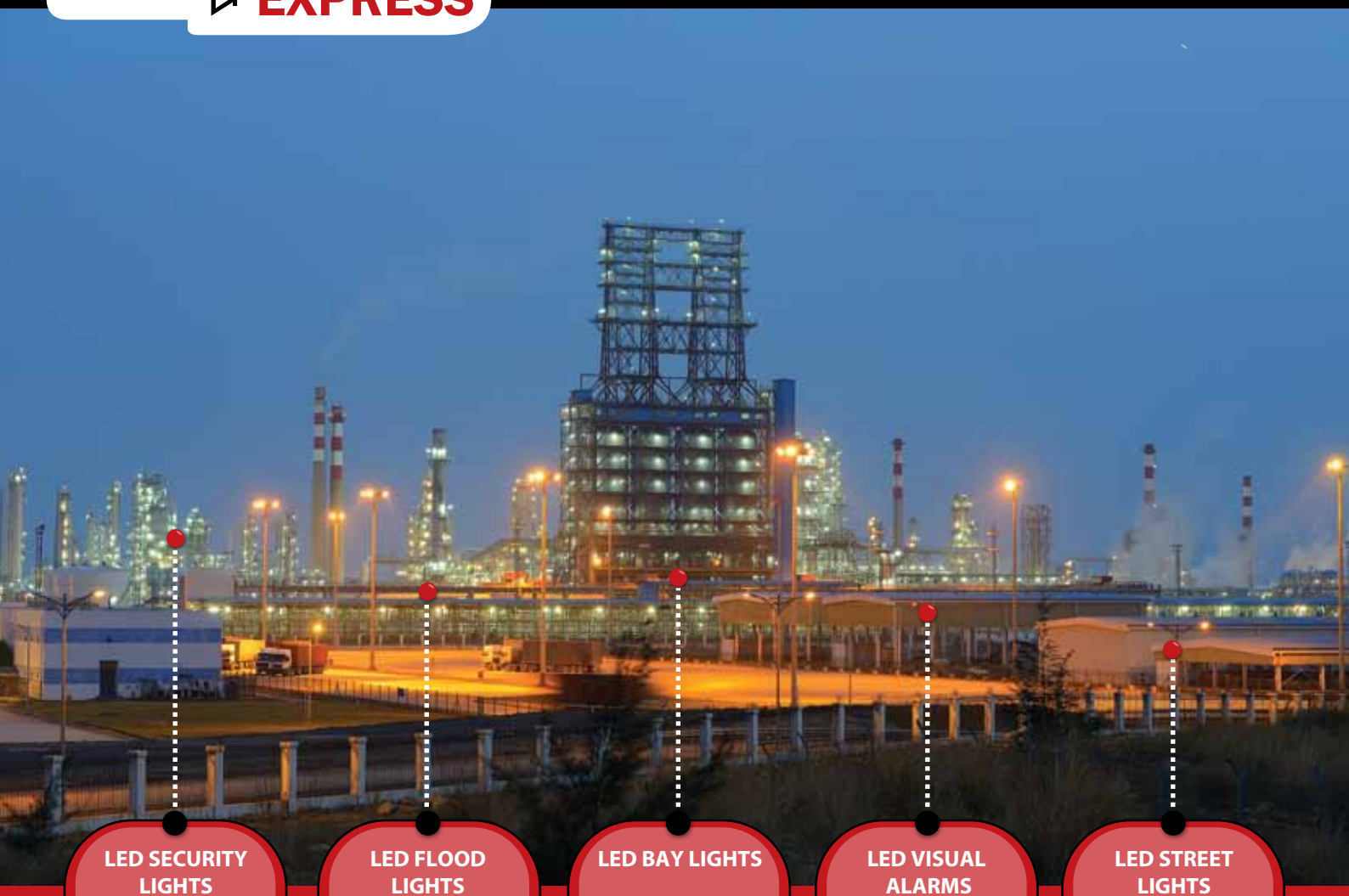

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The Electricity Crisis and Medupi Debacle

THE SAGA CONTINUES

I am a consulting engineer in a small practice. A large part of my duties is to negotiate for new or increased electricity supplies on behalf of my Clients from ESKOM.

BY I GIEL DE KOCK I PR ENG

I have followed the electricity crisis and the Medupi project closely in the media. After all Medupi is mentioned as the solution to the electricity crisis. The latest news on cost and time overruns is of special interest to me.

I have noticed the reasons mentioned in the media: inexperienced staff, insufficient project management, non-performing contractors and labour unrest; and agree with them all. I do believe there is a factor (reason) which has not been mentioned and which might be the most important cause of the problems. This is the way ESKOM treats their normal customers where construction projects are involved and involves new or increased electricity supplies of 1 000kVA and larger.

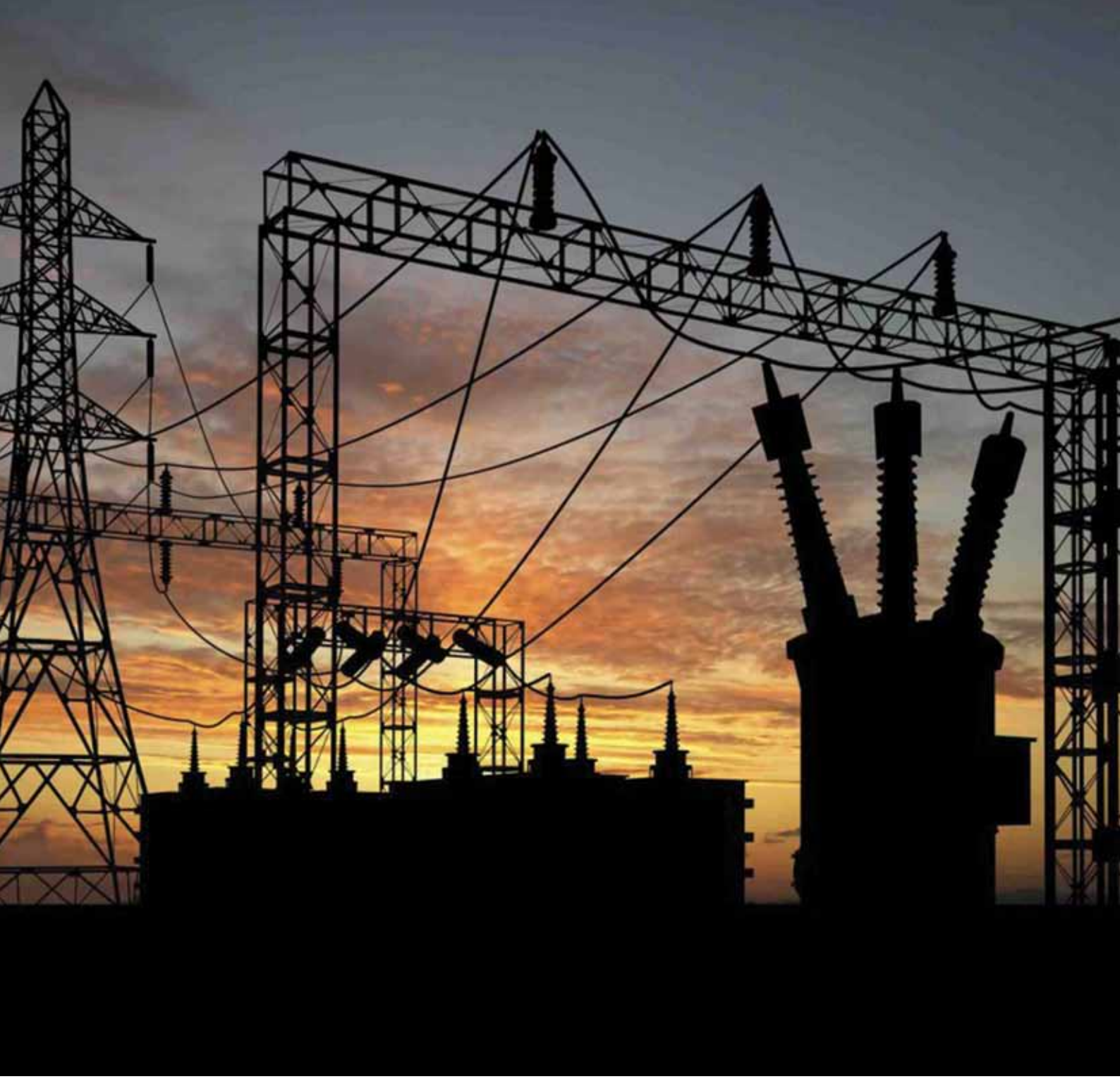
To make my point it is necessary to give a short description of the ESKOM process that is applied for supplies of 1000kVA or larger. This involves the following:

APPLICATION

The application is lodged with ESKOM by the Customer. This person or entity is at this stage already an ESKOM Customer, there is no other option for electricity supply.

FEASIBILITY QUOTATION

This quotation is called a feasibility quotation and states that the confidence level of the quotation is 65%. (None of my Clients are prepared to consider a feasibility for any project with a confidence level of at least 90% or preferably 95%, yet ESKOM expects their customers to make



a decision on a confidence level of 65%). The feasibility quotation makes provision for a quotation fee/commitment fee that the customer must pay before ESKOM will proceed with the process. The customer is therefore forced to pay for a quotation. The fee will be forfeited if the budget quotation is not accepted or deducted from the cost of the budget quotation if it is accepted.

BUDGET QUOTATION

The budget quotation is supplied at a confidence level of 90% It is also expected that the customer must comply with all financial obligations set out in the quotation before work will progress. This normally includes a cash payment for the capital costs and a guarantee as account deposit.

ESKOM also has the right (so it seems) to change the budget quotation at any stage (upwards of course, never downwards). I have experience where ESKOM wants to increase the budget quotation by 100%. If the customer does not accept this change, the project is stopped.

The Electricity Crisis and Medupi Debacle

continues from page 49

TIME FRAMES

The time which is taken by ESKOM in submitting both feasibility and budget quotations can be up to 6 months for each quotation and in a lot of instances even longer. Both quotations are only valid for 30 days.

If not accepted within the 30 days the process has to start again. The implication is clear – ESKOM can take as long as they wish to prepare the quotations while the Customer is forced to accept within 30 days.

IMPLEMENTATION

ESKOM refuses to make any commitment whatsoever for completion of the project. This means that the customer has to pay all cost in advance with no idea if or when ESKOM will complete the project.

The following questions come to mind when considering the Medupi debacle:

- Did ESKOM base the feasibility for Medupi on a 65% confidence level? The financial overrun seems to confirm this.
- Did ESKOM pay for the tenders of their contractors and did ESKOM pay any contractor in advance? Surely not, this would be levelling the playing field between how ESKOM wants to be treated by their customers and how ESKOM treats their contractors.
- What value does ESKOM attach to an accepted quotation/tender from a contractor? If it is the same value as ESKOM attaches to their own quotations it is not worth the paper it is printed on.
- Did ESKOM apply the same principal to time management on the Medupi project as they apply to their customer's projects? It surely seems so from the time overruns.

After being subjected to the above ESKOM process I am not surprised at all about the Medupi situation.

I have read a lot in the media about the damage done to the South African economy by the electricity crisis and the Medupi project. I have never seen any mention of the damage done to our economy by the above ESKOM process.

Every single one of these projects for new electrical supplies involves some form of job creation so the damage must be enormous.

I believe that when the cost of the damage done to the economy by ESKOM's treatment of their customers is calculated the cost of the electricity crisis and the Medupi project will seem like a drop in the ocean.

I hope I am wrong but I fear that I am not. wn

ESKOM refuses to make any commitment whatsoever for completion of the project. This means that the customer has to pay all cost in advance with no idea if or when ESKOM will complete the project.

2014 Membership Fees

Council meeting held on 02 August 2013 approved subscription and entrance fees as from 01 January 2014 will be as per schedule indicated below.

Grade of Membership	Annual Subscriptions paid before 28 February 2014		Annual Subscriptions paid after 28 February 2014		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	125	88	156	110	156	110
After 6 yrs study	804	563	1,005	704	1,005	704
Associate	804	563	1,005	704	1,005	704
Member	889	622	1,111	778	1,111	778
after 6 years	1,039	727	1,299	909	1,299	909
after 10 years	1,087	761	1,359	951	1,359	951
Senior Member	1,087	761	1,359	951	1,359	951
after 6yrs/age 40	1,178	824	1,472	1,031	1,472	1,031
Fellow	1,178	824	1,472	1,031	1,472	1,031
Retired Member (By-law B3.7.1)	499	349	618	436	n/a	n/a
Retired Member (By-law B3.7.3)	nil	nil	nil	nil	n/a	n/a

1. Entrance fee for all grades of membership is R750.00 *(except for Students, which is free).*
2. Transfer fee to a higher grade is R450.00 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 6 and 10 years respectively are equal to the fees at the next higher grade.
4. Members elected after June 2014 pay a reduced membership fee.

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

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

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

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

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

Earn CPD Credits

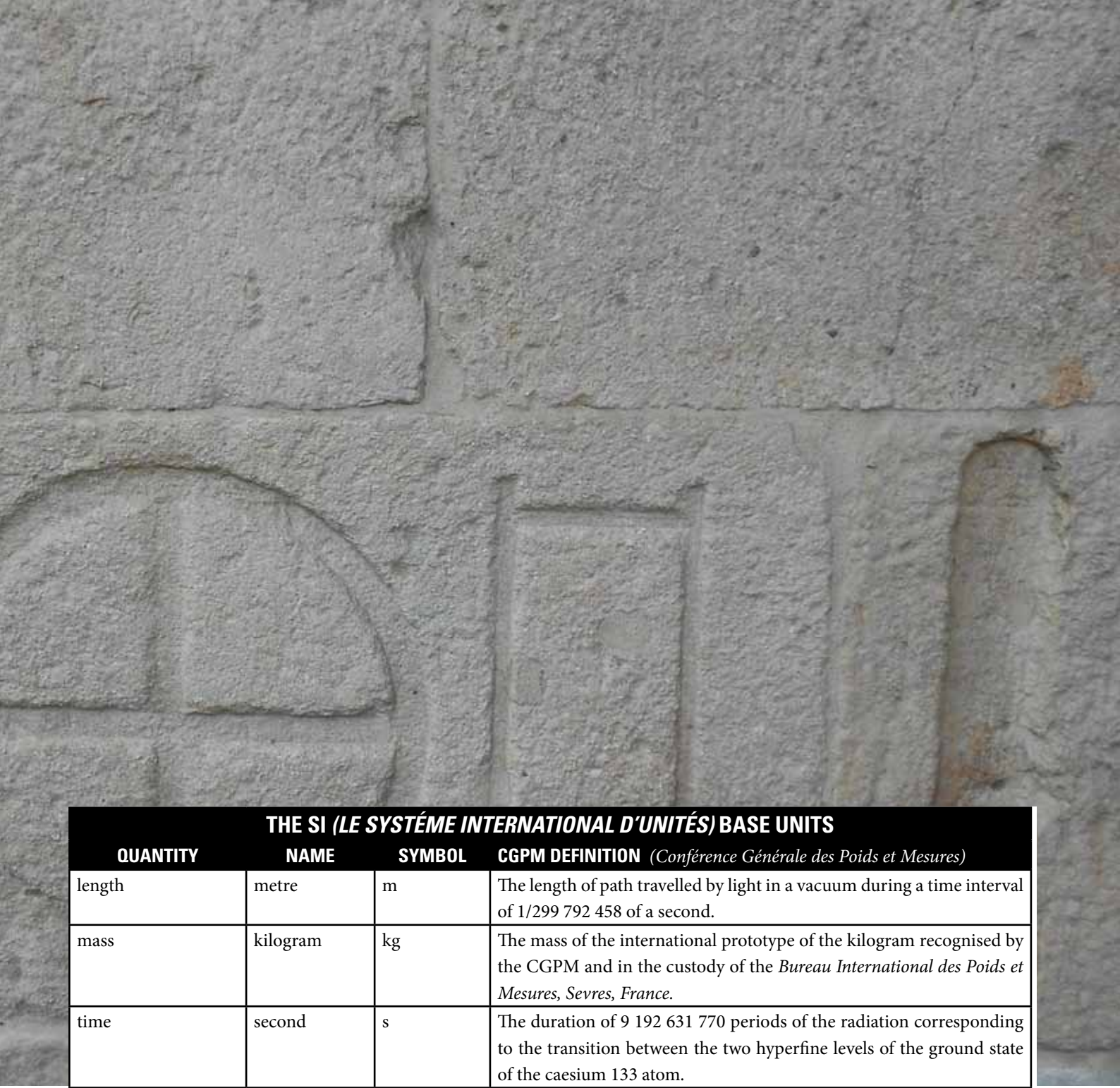
A Celebration of Units and Constants

The weights and measures used by the people of our planet over the millennia is a huge subject which could probably fill several books, but fortunately, we live in enlightened times and the basic definitions of physical units have been reduced to seven which are sufficient for every possible engineering or scientific purpose.

BY | DUDLEY BASSON

The two supplementary units are geometric definitions of the radian and steradian. The SI units are coherent so that other units can be derived from these without the application of conversion factors.

Despite the widespread acceptance of these units, the purists are not yet satisfied. Discussions are underway for the introduction of new definitions for the kilogram, ampere, kelvin and mole. An important aspect of the definition of units is that they should not be dependant on any manufactured prototype and can be accurately realized in an adequately equipped laboratory.



THE SI *(LE SYSTÉME INTERNATIONAL D'UNITÉS)* BASE UNITS			
QUANTITY	**NAME**	**SYMBOL**	**CGPM DEFINITION** *(Conférence Générale des Poids et Mesures)*
length	metre	m	The length of path travelled by light in a vacuum during a time interval of 1/299 792 458 of a second.
mass	kilogram	kg	The mass of the international prototype of the kilogram recognised by the CGPM and in the custody of the *Bureau International des Poids et Mesures, Sevres, France.*
time	second	s	The duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.
electric current	ampere	A	That constant current which, if maintained in two straight conductors of infinite length, of negligible circular cross section, and placed one metre apart in vacuum, would produce between these conductors a force of 2×10^{-7} newton per metre of length.
thermodynamic temperature	kelvin	K	The fraction 1/273,16 of the thermodynamic temperature of the triple point of water.
amount of substance	mole	mol	The amount of substance of a system which contains as many elementary entities as there are atoms in 0,012 kg of carbon 12.
luminous intensity	candela	cd	The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

Table 1

A celebration of units and constants

continues from page 53

CONSTANT	VALUE	UNITS	
c Speed of light	2,99 792 458 x 10^{8}	m s^{-1}	m s^{-1}
h Planck's constant	6,626 06 x 10^{-34}	J s	s^{-1} m^{2} kg
e elementary charge	1,602 17 x 10^{-19}	C	A s
k Boltzmann constant	1,380 65 x 10^{-23}	J K^{-1}	s^{-2} m^{2} kg K^{-1}
N_A Avogadro constant	6,022 14 x 10^{23}	mol^{-1}	mol^{-1}
The values have been truncated and the uncertainty ranges removed.			

Table 2

As a requirement for the new definitions, natural constants must be declared to have exact values (Table 2).

The kilogram is the only remaining unit defined by a securely kept prototype. It has been found that kilogram prototypes distributed to various countries have, over the years, changed in mass by up to 200 micrograms. It is not possible to determine whether any of the prototypes have remained unchanged or even lost mass.

It has been suggested that the mass gain is due to absorption of mercury atoms from the atmosphere. Kilogram prototypes are extremely expensive polished platinum-iridium cylinders. The proposed definition will dispense with a prototype and define the kilogram in terms of photon energy requiring an exact value for Planck's constant.

The ampere cannot be directly realized from the present definition. The new definition specifies the ampere in terms of the electron charge which now has an exact value. In electrical calculations ampere current is represented by the symbols 'I' or 'i'. This is an abbreviation of Ampere's usage *'Intensité du courant'*.

The new definition of the kelvin will be based on an exact value of the Boltzmann constant which will make it dependant on the definitions for the second, metre and kilogram.

The new definition of the mole will not specify the atoms in a quantity of matter but will be directly taken from an exact value of Avogadro's constant. The method of realizing the values from the definitions is known as the *'mise en pratique'*.

The metre has experienced several redefinitions. The original value was meant to represent one ten millionth of part of the meridian from the North Pole to the equator passing through Paris. The metre was also defined in terms of the length of a pendulum. The more senior amongst us will remember the metre being defined by means of a platinum-iridium bar prototype, the ohm as the resistance of a column of mercury and the ampere by the deposition of silver in an electrolyte.

From 1960 to 1983 the metre was defined in terms of light wavelengths of krypton 86 but astonishing improvements in the measurement of time have resulted in the present definition based on the speed of light. The metre is now defined to nine significant digits which would be impossible to attain from a prototype. Now that the speed of light is used to define the metre we have an exact value for this most fundamental constant of the universe.

Many units can be derived from the base units as shown in Table 3.

In electronic work the farad is inconveniently large so that capacitors are commonly specified in microfarads or picofarads. The tesla is also sometimes found to be inconveniently large so that the CGS unit gauss is used instead. One tesla = 10^{4} gauss. In cosmology the tesla is not a large unit. In cataclysmic collisions between neutron stars which then instantly form a black hole, transient magnetic fields in the petatesla range can occur.

THE NATURAL PLANCK UNITS OF THE UNIVERSE

Max Planck is famous for his discovery of one of the fundamental constants of the universe – the Planck quantum of action or 'Planck's constant' denoted by the symbol 'h'. The quantity 'action', the product of momentum and length, is not commonly used in engineering but is fundamental in physics. Planck's constant applies equally to all photon quanta and when multiplied by frequency gives the value of photon energy.

In 1899 Planck conceived the idea of natural units where the physical constants would all have a value of unity. The units were time, length, mass, electric charge and temperature. Planck said of his units: *"… these necessarily retain their meaning for all times and for all civilizations, even extraterrestrial and non-human ones, and can therefore be designated as "natural units"*.

The following constants become unity when expressed in terms of Planck units: Speed of light in vacuum, Gravitation constant, Dirac's constant (h/2π), Coulomb constant and Boltzmann constant.

QUANTITY	NAME	SYMBOL	EXPRESSION IN TERMS OF OTHER SI UNIT	EXPRESSION IN TERMS OF BASE UNITS
frequency	hertz	Hz	s^{-1}	s^{-1}
force	newton	N	kg m / s^2	kg m s^{-2}
pressure	pascal	Pa	N / m^2	m^{-1} kg s^{-2}
energy	joule	J	N m or W s	m^2 kg s^{-2}
power	watt	W	J / s or V A	m^2 kg s^{-3}
electric charge	coulomb	C	A s	A s
electric potential	volt	V	W / A	m^2 kg s^{-3} A^{-1}
capacitance	farad	F	C / V	m^{-2} kg^{-1} s^4 A^2
electrical resistance	ohm	Ω	V / A	m^2 kg s^{-3} A^{-2}
magnetic flux	weber	Wb	V s	m^2 kg s^{-2} A^{-1}
magnetic induction	tesla	T	Wb / m^2	kg s^{-2} A^{-1}
inductance	henry	H	Wb / A	m^2 kg s^{-2} A^{-2}

Table 3

The plank units give astonishing values when expressed in SI units:

UNIT	SI EQUIVALENT VALUE
Planck time	5,391 x 10^{-44} s
Planck length	1,616 x 10^{-35} m
Planck mass	2,716 x 10^{-8} kg
Planck charge	1,875 x 10^{-18} C
Planck temperature	1,414 x 10^{32} K

Table 4

Many other units can of course be derived from the basic five units:

Planck current 3,479 x 10^{25} A
Planck energy 1,956 x 10^{9} J
Planck force 1,210 x 10^{44} N
Planck power 3,628 x 10^{52} W
Planck density 5,155 x 1096 kg m^{-3}
Planck pressure 4,633 x 10^{113} Pa
Planck voltage 1,043 x 10^{27} V
Plank magnetic induction 2,153 x 10^{43} T

Planck time and length are well used in theoretical physics but most of the other units are too extreme to be of practical use. The Planck unit of electric charge is nearly twelve times larger than the electron charge and does not represent any physical particle in whole, fraction or multiple.

This does however lead to another fundamental constant of the universe.

The electron charge/ Planck charge ratio squared gives us the Sommerfeld fine structure constant which deals with photon ejection and absorption and other matters in particle physics. This value is important – if it were different by 4% carbon would not be produced in stellar fusion and if it were greater than 0,1 stellar fusion would not occur at all leaving us with a universe consisting of nothing but hydrogen.

Prof. Arnold Sommerfeld tutored many of the most eminent physicists of the early 20th century, several of whom were to become Nobel laureates. Physicist Richard Feynman despaired of ever finding an analytical derivation of the fine structure constant. The constant can be very accurately determined experimentally but can also be calculated using: the electron charge, electric permittivity of space, Planck's constant and the velocity of light.

Astrophysicists have recently discovered that the fine structure constant varies slightly along an axis through the universe – this variation is not huge – about one part in 100 000 but this poses a major problem to the scientists.

Another profound equation of the universe is the Maxwellian:

$$\varepsilon_0 \mu_0 c^2 = 1$$

which expresses the velocity of light in terms of the electric permittivity and magnetic permeability of space.

THE SI PREFIXES

The SI prefixes provide a most convenient way of expressing very large and small numbers without using decimal exponents. The names are loosely derived from the Greek numbers for the groups of three.

The high values have the Italian female ending 'a' and the small values the male ending 'o'.

The original metric system prefix definitions were not in accordance with this usage and are indented in the table.

Presumably, at the time, more than a thousand of anything was considered quite a lot. The prefix 'myria' (10^4) fell into disuse but can still be seen in old records. The terms million, billion, trillion etc. have an unfortunate legacy of long and short scales. (*échelle court* and *échelle longue*).

A celebration of units and constants

continues from page 55

The long scale was in use in the UK until 1974 but the confusion remains when referring to old books.

PREFIX	SYMBOL	VALUE	
yotta	Y	10^{24}	
zetta	Z	10^{21}	
exa	E	10^{18}	
peta	P	10^{15}	
tera	T	10^{12}	
giga	G	10^{9}	
mega	M	10^{6}	million
kilo	k	10^{3}	thousand
hecto	h	10^{2}	hundred
deca	da	10^{1}	ten
		10^{0}	one
deci	d	10^{-1}	tenth
centi	c	10^{-2}	hundredth
milli	m	10^{-3}	thousandth
micro	µ	10^{-6}	millionth
nano	n	10^{-9}	
pico	p	10^{-12}	
femto	f	10^{-15}	
atto	a	10^{-18}	
zepto	z	10^{-21}	
yocto	y	10^{-24}	

Table 5

The prefixes must be joined to the unit without space or hyphen. The standard does not permit the combination of prefixes; a micro-kilogram must therefore be simplified to milligram.

Some confusion has arisen with the use of SI prefixes in the data processing and data transmission industries. Computer storage size is normally given as exponents of 2, so that a kilobyte would normally mean 1024 bytes, 210 and not 1000 bytes, 103. A new system of prefixes has been developed by the International Electrotechnical Commission with the strong support of the International Committee for Weights and Measures.

These prefixes apply only to computer memory and data storage and not to processing speed where the SI unit hertz still applies. These binary prefixes do not form part of the SI standard.

PREFIX	SYMBOL	VALUE	DECIMAL
kibi	ki	2^{10}	1 024
mebi	Mi	2^{20}	1 048 576
gibi	Gi	2^{30}	1 073 741 824
tebi	Ti	2^{40}	1 099 511 627 776
pebi	Pi	2^{50}	1 125 899 906 842 624
exbi	Ei	2^{60}	1 152 921 504 606 846 976

Table 6

The SI had its roots in troubled times when the centuries old French Monarchy was violently overthrown and the new Government sought to make a complete break from associations with Church and Monarchy. The metric system was one of several systems making a break with the past. Members of the public were required to address each other as "citizen" rather than Monsieur or Madame.

Possibly the most radical change was the introduction of a new calendar and time system known as The French Republican Calendar.

The days were divided into ten hours of 100 minutes, which were further divided into 100 seconds. The year had four seasons of three months each which were divided into three weeks of ten days. Days and months were all given new names and a name was also assigned to every day of the year. Street and place names were also changed. Across the English Channel the changes were derided as the "French Folly". Chaos reigned supreme and the beleaguered public no longer knew the time of day, the day of the week or even their home address. The month names were chosen to represent the time of year and had endings to signify the seasons.

Autumn: Vendémiaire, Brumaire, Frimaire
Winter: *Nivôse, Pluviôse, Ventôse*
Spring: *Germinal, Floréal, Prairial*
Summer: *Messidor, Thermidor, Fructidor*

On the other side of the Channel the month names were spoofed with:
Wheezy, Sneezy and Freezy; Slippy, Drippy and Nippy; Showery, Flowery and Bowery; Wheaty, Heaty and Sweety. The name of the month Thermidor can still be sometimes seen on restaurant menus as the name of a spicy crayfish recipe. Charts for converting Republican dates to Gregorian dates are available to historians and genealogists working in the post-revolutionary period.

The systems remained in use for 12 years until the old systems were reinstated by Napoleon in 1806.

Fortunately the new metric system survived

and has been developing ever since. Originally the system had only two units – the metre and the grave (kilogram) defined as the mass of a cubic decimetre of water. Early development of the metric system was done by chemistry pioneer Lavoisier and mathematicians Laplace and Legendre.

Gauss contributed by describing the earth's gravitational field in absolute units and laid the foundations for a coherent system based on length, mass and time. Sadly, Lavoisier did not survive the Revolution. Contemporary scientist Fourier narrowly escaped the guillotine. Fourier joined the large delegation of scientists and other experts on Napoleon's invasion of Egypt. Fourier is famous for his work on heat flow. His discovery that a complex wave form can be synthesized by a series of simple sinusoidal waves of higher frequencies and smaller amplitudes would become of immense value to electrical engineering a century later. Maxwell and Lord Kelvin formulated the requirements for a coherent system of units and played a role in developing the practical electrical units of measure.

Several new units were added to the metric system to develop it into the CGS (centimeter, gram, second) system. A major advance was made by Giovanni Giorgi in 1900 to improve the electrical units by introducing a single electrical base unit integrating the ESU (Electrostatic units) and the EMU (Electromagnetic units) into a coherent system, which then became the Giorgi System – the forerunner of the MKS (metre, kilogram,second) system.

This was later to become the SI. The CGPM was established in 1875. At present the CGPM has 56 member states and 37 associate member states.

In 1960 the 11th CGPM approved the SI, *Le Systéme International d'unités.*

October

COMPILED BY | JANE BUISSON-STREET
SMSAIEE | PMIITPSA

The eighth month in the old Roman calendar, October retained its name (from the Latin "octo" meaning "eight") after January and February were inserted into the calendar that had originally been created by the Romans.

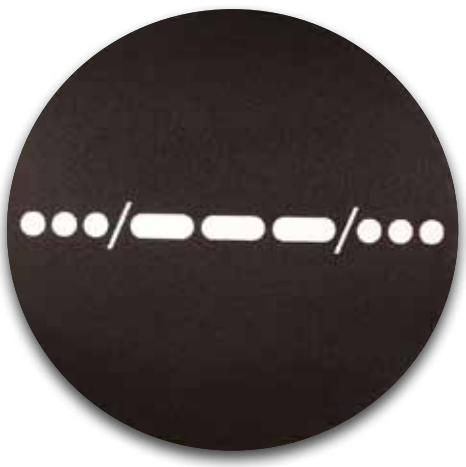
1 October

1829 The South African College is founded in Cape Town, South Africa. Later it was to separate into the University of Cape Town and the South African College Schools.

1880 The Edison Lamp Works operations to manufacture the first electric light bulbs in New Jersey, USA.

1936 The BBC begins regular television broadcasts from Alexandra Palace in London.

1987 Mrs Pat Anthony, 48, surrogate grandmother, gives birth to triplets for her daughter Karen Ferriera-Jorge in Johannesburg, South Africa.



3 October

1906 SOS is established as the international distress call replacing CDQ (sometimes interpreted as "Come Damn Quick").

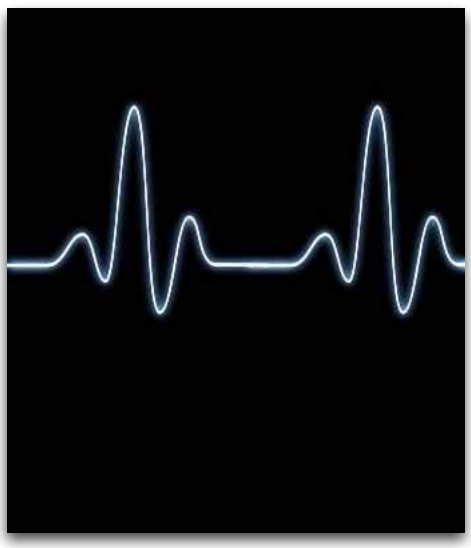
1955 The Mickey Mouse Club debuts on ABC.

1985 The Space Shuttle Atlantis makes its maiden flight.

4 October

1535 The first complete English-language Bible (the Matthew Bible) is printed. The translations were done by William Tyndale and Miles Coverdale.

1905 Orville Wright is the first person to fly an aircraft for more than 33 minutes.



1952 David Schwartz is fitted with an external device to control his heartbeat. Dr Paul Zoll of Harvard Medical School developed this device, a pacemaker.

5 October

1952 Her majesty's government has taken a significant step towards reviving the nation's addiction to tea by removing it from the list of rationed commodities.

1969 A new 13-episode comedy show is launched by the BBC on late-night television that seems set to raise a few eyebrows: Monty Python's Flying Circus.

6 October

1902 A 3200km railway line running from Cape Town, South Africa, to Beira, Mozambique, is completed.

10 October

1975 After a tumultuous past during which they have already married and divorced, Elizabeth Taylor and Richard Burton remarry in a remote village in Botswana.

12 October

1899 The Boer states have responded to Britain's dispatch of troops to South Africa by issuing a declaration of war, and they have drawn first blood. The British military garrison at Mafeking, under Colonel Robert Baden-Powell, is under siege by Boer forces.

15 October

1582 Pope Gregory XIII has decreed that ten days be dropped from the calendar. The Julian Calendar calculated a year as 365 ¼ days which is an overestimation of 11 minutes and 14 seconds. The equinox this year fell on March 11, 14 days earlier than in Caesar's time. By losing ten days this month and then having leap years (years that are divisible by 400), the new calendar should now work.

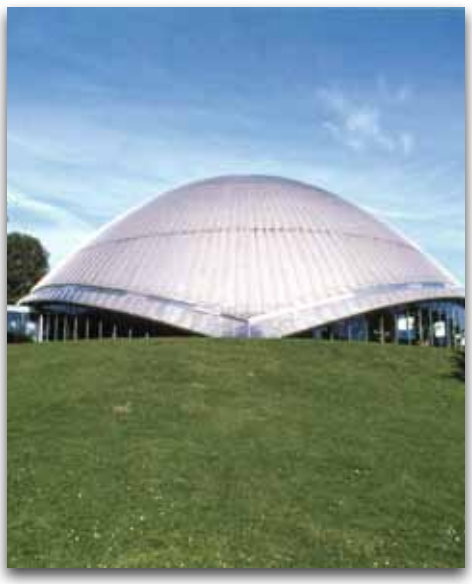
1993 ANC leader Nelson Mandela and South African President F.W. de Klerk have today been awarded the Nobel Peace prize. This is an acknowledgment of their commitment to build a peaceful, multi-racial South Africa.

17 October

1988 Researcher Barry Cooper pieced together fragments of the manuscript and sketches discovered in Berlin that resulted in Beethoven's tenth symphony being performed for the first time today in London.

18 October

1931 Thomas Alva Edison, America's most prolific inventor, died at the age of 84. His lack of formal education proved to be no handicap. His inventions include the phonograph, microphone and the kinetoscope, and he designed a complete electrical distribution system for lighting and power.



21 October

1923 The world's first planetarium opens in Munich.

22 October

1962 ANC leader Nelson Mandela goes on trial for treason in South Africa, pleading Not Guilty.

24 October

190 Mrs Ann Edison Taylor remains unhurt after going over the Niagara Falls in order to raise funds to pay the mortgage. She used a padded barrel.

2003 Concorde is making its final flights today after 27 years of supersonic flight.

25 October

1400 Geoffrey Chaucer, the courtier, diplomat, civil servant and poet, died at his home in the gardens of Westminster Abbey.

28 October

1831 Physicist and chemist Michael Faraday has succeeded in inventing a machine that converts mechanical energy into electrical energy. After he discovered that a current of electricity can be generated by plunging a magnet into a coil of wire, he set about trying to generate a steady current. He achieved this by spinning a copper disc between the poles of a magnet. Faraday is 40 years old and left school at 14 when offered a job by Humphrey Davy, the director of the Royal Institution's laboratory.

29 October

1963 The Red Cross is founded by Swiss philanthropist Henri Dunant.

1998 The Truth and Reconciliation Commission, set up to investigate the causes and results of Apartheid, reports after two years of hearings.

31 October

1940 The Battle of Britain ends: the Royal Air Force has lost 915 aircraft, the Luftwaffe 1733.

1958 Dr Ake Senning implanted the very first internal pacemaker in Stockholm. wn

'The Lights are ON but no one is home'

.....a clichéd phrase, uttered by my husband, usually after he has tried to give me an overly detailed response to my obligatory 'so how was your day? Truth be told, I only ask the question out of politeness and am wondering when he will realise that his answer is not being absorbed.

BY I ANGELA PRICE

In fact, to say it goes 'in one ear and out the other' would be too positive – implying that it has actually passed through my gray matter. Sadly for him, his responses don't even penetrate my brain, which is about as sharp as a marble by the time he gets home. This is primarily due to the fact that I have been chasing screaming kids around trying to get them into and out of the bath (I am seriously considering just rubbing them down with waterless hand sanitizer before bed).

I recently got to thinking about this overly used cliché and began 'unpacking' it. It is defined as being 'a derogatory expression, used to describe someone who is not very smart or who is dumb.' Looking at it logically, the start of the idiom, *'The lights are on'*, implies that there are signs of life and that the person appears to be 'all there' …however the follow on - *'but no one's home'* - tells us that the 'building' is empty and vacant. However, opinions seem to vary about its exact meaning and therefore the use of the expression.

For instance, some parties believe that it describes someone as being stupid, whilst others think it implies that the person at whom the statement is aimed, is simply not concentrating or their mind is wandering and/or *'vacant'*….and even others think that it means that you are *'loony'* and have *'lost the plot'* (For the record, all of these answers would be quite applicable to my state of mind at the 5pm 'suicide' hour when my husband gets home).

When questioned about the meaning of the phrase, one energy conscious individual (who shall remain nameless for the purposes of this article) felt that the expression refers to wasting electricity!

This unexpected response got me thinking about the whole phrase even further…. resulting in some interesting thoughts. For example…how many of us have used the *'lights are on but no one's home'* as a cheap security strategy in an attempt to fool would be burglars into thinking that we are in fact home. Possibly this is becoming a thing of the past as 'hi-tech' security devices are now almost mandatory for every household and I think many of us would rather the bugler knows we are not there, gets in and gets out, with us being none the wiser until our return home. Not to mention that from a cost saving perspective it is possibly cheaper to install an alarm system rather than leaving your lights on whilst out of the house.

With things like *'home automation'* and motion sensors/detectors coming down in cost and the price of electricity continuously rising, the reality is, there may come a time when there would be no such thing as the *'lights are on but no one's at home'*. Things like motion sensors integrated into a simple home automation system can contribute towards a substantial energy saving. With things going the way they are with the cost of electricity, not to mention our environmental responsibility, the *'lights being on with no one home'* will likely become a rare occurrence.

Thanks to Eskom's recently 'intermittent' service delivery, a truer South African saying might be *'The lights are OFF, but everyone IS home'*. Someone had better warn the burglars ... wn

Have some fun and stand a chance to win R1000.
Complete the August issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, October 2013 Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *minx@saiee.org.za*. The completed crossword puzzle should reach us by no later than **31 October 2013**. The winner of R1000 will be announced in the January 2014 issue of the **watt**now magazine.

R1000 win

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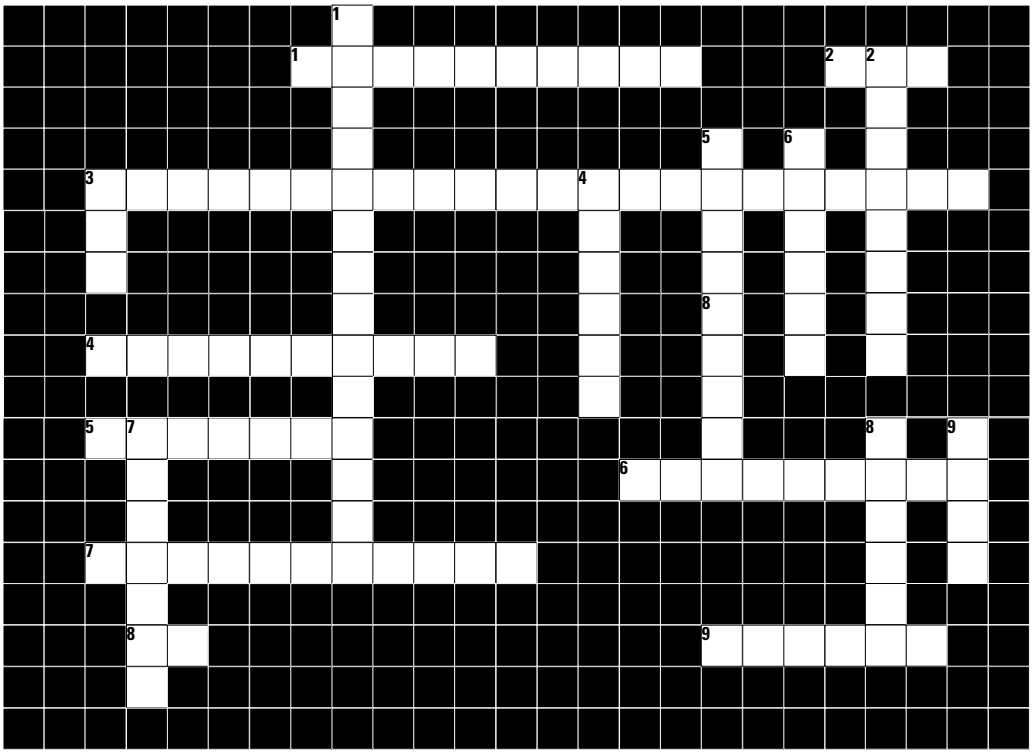

ACROSS

1. Measurement of light (10)
2. Compact fluorescent lamps (abbr.)
3. LED (5,8,5,4)
4. The illuminance cast on a surface by a one-candela source one foot away. (10)
5. See 4 down. (7)
6. This is an uplight intended for ambient lighting. It is typically a floor lamp but may be wall-mounted like a sconce. (9)
7. A tube coated with phosphor containing low-pressure mercury vapour that produces white light. (11)
8. International System of Units (abbr.)
9. Visible light output is typically measured in _____ (6)

DOWN

1. The temperature at which all thermal motion ceases. (14)
2. An incandescent light bulb is an electric light, which produces light with what type of wire? (8)
3. One lumen per square metre. (3)
4. In 1849, who devised a method to distil kerosene from petroleum? (6)
5. What instrument do you use when measuring light? (9)
6. These lights are positioned at the inter-section of two roads to aid in navigation. (6)
7. This is an auxiliary piece of equipment designed to start and properly control the flow of power to discharge light sources such as fluorescent and high intensity discharge (HID) lamps (7)
8. What is known as the unit of measurement for temperature in lightbulbs? (6)
9. A low-pressure gas contained within a glass tube; the colour emitted depends on the gas. (4)

August issue answers:

ACROSS

1 George **2** Rectifier **3** William
4 Inverter **5** Michael **6** Polyphase
7 René Thury **8** Arclight
9 Stanley **10** Browne

DOWN

1 Westinghouse **2** Bergman
3 Faraday **4** Bill **5** Moutiers-Lyon
6 Girls & Boys Town **7** DC **8** Thomas
9 Delta **10** AC

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. Closing date for entry is 31 October 2013. 7. The winner will be announced in the January 2014 issue of the **watt**now magazine. 8. The Managing Editor's decision is final and no correspondence will be entered into.

Calendar of events

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

OCTOBER 2013

9-11	Africa Electricity 2013	Sandton, Johannesburg	www.africaelectricity.com
13-17	22nd World Energy Congress, DAEGU 2013	Daegu, Korea	www.daegu2013.kr
18	President's Summer Colloquium	SAIEE House, Johannesburg	geyerg@saiee.org.za
22-24	FILTECH International Conference & Expo	Wiesbaden, Germany	www.filtech.de
23	SANEA Lecture	Cape Town	www.sanea.org.za
23-24	CPD Course: Stress & Time Management	SAIEE House, Johannesburg	roberto@saiee.org.za
29-31	Johburg Indaba, Investing in Resources & Mining in Africa	Sandton, Johannesburg	www.joburgindaba.com
30-31	Robmech 2013	University of KZN, Natal	www.robmech.co.za

NOVEMBER 2013

1	Annual SAIEE Banquet	Wanderers Club, Johannesburg	geyerg@saiee.org.za
4-5	CPD Course - Short circuit currents	SAIEE House, Johannesburg	roberto@saiee.org.za
19-20	CPD Course - Mastering Series	SAIEE House, Johannesburg	roberto@saiee.org.za
26-29	CPD Course - Project Management	SAIEE House, Johannesburg	roberto@saiee.org.za
28	SAIEE National Student's Competition	University of Pretoria	geyerg@saiee.org.za

FEBRUARY 2014

5-6	CTEX Career and Training Expo	Good Hope Centre, Cape Town	www.ctex.co.za
18-20	Africa Energy Indaba	Sandton Convention Centre, Johannesburg	www.africaenergyindaba.com

13-17 OCTOBER 2013
DAEGU I KOREA

For more info visit:
www.daegu2013.kr

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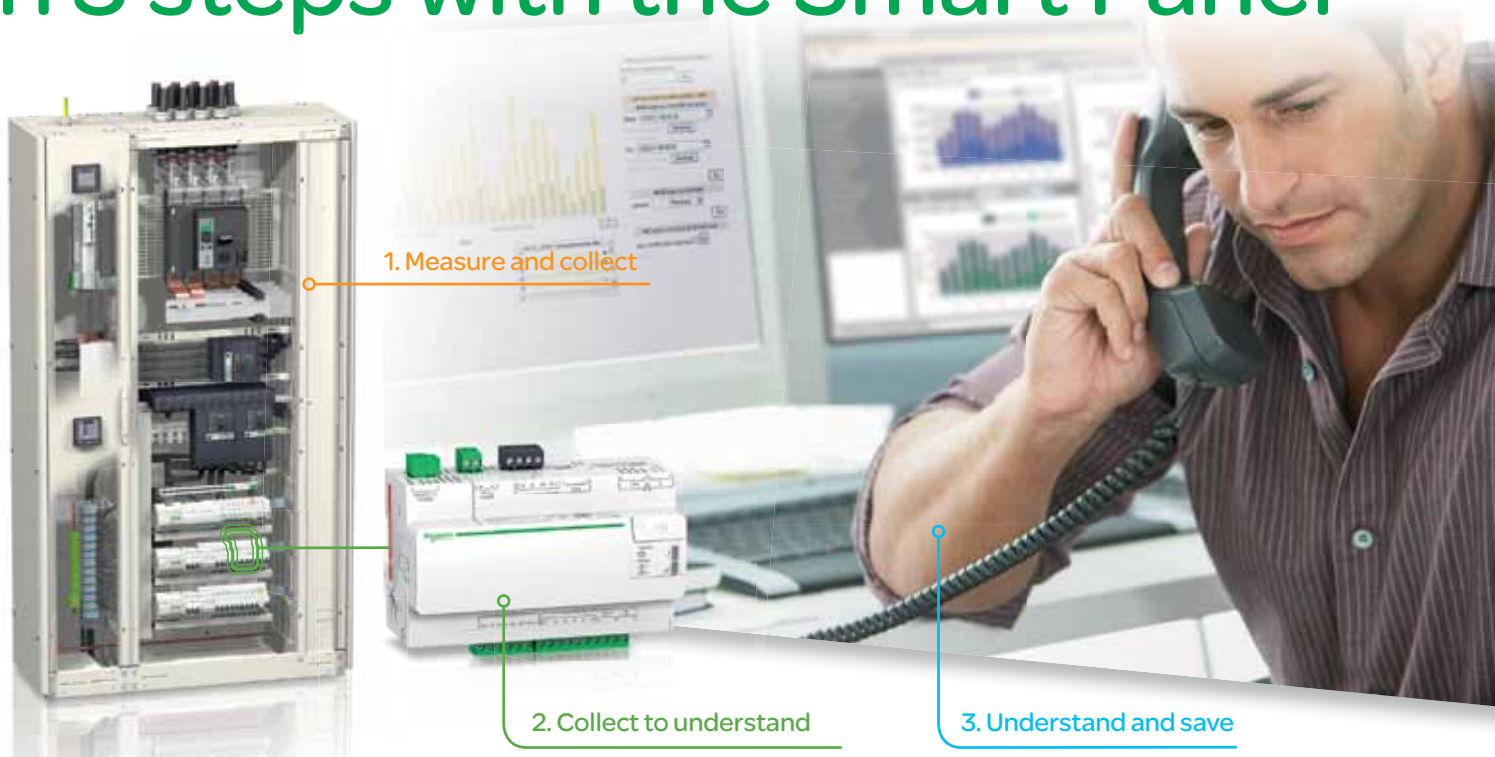

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