

# WATTnow

Be Enlightened

## Africa faces an energy time bomb

**Nanotechnology** investment will help SA scientists

Inkjet technology can heal burns

Clever women drink more than dumb women

Official Magazine of



April 2010



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Answers for South Africa.

**SIEMENS**

# The plan for universal access to energy for all of Africa?

The World Energy Council estimates that Africa will have to spend \$14-billion a year for the next 30 years to get basic electricity services to the population. That sounds like a rather paltry amount of money to me given the sad state of the electricity supply in Africa where countries like Nigeria have lost almost all their generating capacity.

In fact when I was in Lagos for several visits, every company that I called on relied on diesel generators because of the sporadic supply of electricity in that city alone. However, the World Energy Council says that Africa must spend \$420-billion over the next 30 years.

Of course the World Energy Council puts a different spin on it completely. It says, for instance, that ExxonMobil's turnover for the 2007 financial year was \$477,3-billion while Shell, in the same year, had annual revenue of \$355-billion. So the figures that need to be spent to provide universal access to electricity for all Africans, says the Council, is rather paltry.

Perhaps they are right but I can't help feeling that this is a hopeless under-estimate of what the real needs for Africa are. Take South Africa alone. It is spending R375-billion or almost \$51-billion by itself on meeting its power needs between now and 2020 and will have to spend considerably more than in the decade beyond that.

Perhaps the World Energy Council is hoping that the renewable energy resources will mean that once the capital expenditure has been made the costs of supplying energy will drop significantly. But the reality of the African situation is that maintenance is crucial and sadly the state of the electricity infrastructure is due in part to the lack of maintenance at all levels.

Even in the wealthy countries of South Africa and Nigeria, the maintenance of the distribution network is poor and Eskom has warned that billions of rands will have to be spent to get this country's distribution network back into tip-top condition.

This applies equally to Egypt, Libya, Namibia, Botswana, Tunisia and Gabon, the Top Seven countries capable of meeting their energy needs. So what about those other countries that have huge potential to generate power, such as the Democratic Republic of Congo (DRC) and its Inga projects?

Can you imagine the difficulties that face that country in getting a distribution network to the remote parts of the war-ravaged country where roads have all but vanished into the jungle and where the villages are at best scattered and remote?

And the key factor, once again, is that in order to maintain something like an electricity distribution grid you have to have a battalion of skills that have access to the transmission lines, to the power stations and sub-stations and the final village distribution points.

Much of the blame for a lack of maintenance in every African country is that the skills do not exist to keep the networks running. And the excuse that is constantly proffered is that they do not have the money or the necessary training.

Essentially, I think this is Africa's own fault. Fortunes of money are dragged out of the ground in terms of the minerals, the fossil fuels, the diamonds and the rare metals. And governments earn fortunes from these sources. But where does all that money go? No one can tell you for sure. It evaporates.

What Africa is lacking is the determination to invest in education and training, to invest in its people and to ensure that it not only attracts skills but is capable of retaining them. That is certainly a key for the future of the continent. How Africa will develop the imperative to maintain the assets it has is beyond me but then perhaps I am just far too cynical.

I fear that the World Energy Council's estimates with regard to universal access to electricity for all people in sub-Saharan Africa by 2030 at a cost of \$14-billion a year are little more than a pipe dream.

However, more intelligent people than me have made predictions that were hopelessly wrong so let's hope that mine are just that. Hopelessly wrong.

Paddy Hartdegen - Editor  
paddyh@crowm.co.za



**WATT**now

**Editor**  
Paddy Hartdegen  
paddyh@crowm.co.za

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Adèl JvR Bothma

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**Publisher**  
Jenny Warwick

**Deputy Publisher**  
Karen Grant  
crownmag@crowm.co.za

**Technical Advisor**  
Ian Jandrell, PrEng, PhD

**Advertising Manager**  
Veronica Breedt  
veronicab@crowm.co.za

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All enquiries for WattNow:  
P O Box 140  
Bedfordview, 2008

All enquiries for SAIEE:  
P O Box 751253  
Gardenview, 2047  
crouchm@saiee.org.za



**SAIEE 2009 Office Bearers**  
President: du Toit Grobler  
Deputy President: Angus Hay  
Vice President: Andries Tshabalala  
Vice President: Mike Cary  
Past President: Ian McKechnie  
Honorary Treasurer: Les James

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# Create innovate and win!

## Energy-saving tips Adopt these energy-wise habits:

- Turn off the geyser if you're going away for longer than 48 hours.
- Switch off the television, computer, and similar appliances when you're not using them.
- Replace regular light bulbs with energy-saving ones – they use a quarter of the electricity and last six to eight times longer.

Now is your chance to show off your creative talent and help save electricity in the Eskom Energy Efficient Lighting Design Competition 2010. With the energy challenges facing this country, there is increased demand for energy-efficient light sources in homes.

### SAVE AND WIN

Put on your creative cap and design a lampshade that can accommodate an energy-efficient globe, or submit an innovative energy efficient design, system or product. The idea is ultimately to turn a brilliant design into one that finds its way into our homes.

Your design should be visually and aesthetically pleasing, and environmentally friendly. It should also be functional, practical and user-friendly.

The closing date for entries is 30 July 2010 and you can participate in the student or professional category.

### PRIZES

#### Category A: Students (Individual)

First prize: R30 000

Second prize: R20 000

Third prize: R10 000

Prize for the winner's educational institution: R10 000

Ten most promising previously disadvantaged designers: R1 000 each

#### Category B: Professional

Innovative energy efficient lighting design: R30 000

Top 20 regional finalists: R5 000 each

For more information go to [www.lighting-design.co.za](http://www.lighting-design.co.za), call the competition organisers on (012) 997 1334 or e-mail [amroux@mweb.co.za](mailto:amroux@mweb.co.za).

## Here's how to record partial discharges

**E**A Technology has launched what it claims is the world's most powerful and versatile portable system for investigating and recording partial discharge (PD) activity. Called the UltraTEV Locator, the dual probe instrument features six different sensor technologies to detect and gather information about PD activity, which EA Technology says is a factor in 85 percent of disruptive substation failures.

EA Technology International's director, Neil Davies, says the UltraTEV Locator is a third generation product offering a multi-functional system which delivers a highly detailed assessment of the condition of live assets, so operators can optimise maintenance and prevent faults developing into failures.

Both of the UltraTEV Locator™'s probes use ultrasonic and Transient Earth Voltage (TEV) sensors to locate and measure PD activity on the surface of assets and internally. In addition, the system measures environmental conditions, which affect PD in the form of temperature, relative humidity and air pressure. PD activity in cables is measured using a plug-in Radio Frequency Current Transfer (RFCT) sensor, displaying results as pC (pico Coulomb) numerical values or in graphical form.

In one-shot survey mode, a single probe is used to detect and measure the presence of PD activity. Switching to location mode, both probes are deployed, using time of flight measurement to calculate

the site of PD activity to an accuracy of 2ns (nanoseconds), equivalent to 60cm. In comparative measurement mode, operators can measure surface PD activity in the form of decibel readings in the ultrasonic range and compare results with those taken from other assets.

All measurements taken by the system, including heterodyne sound recordings, can be saved to the UltraTEV Locator™'s internal memory and recalled on the touch-screen display.

The battery-powered UltraTEV Locator is supplied in its own carry-case and is compatible with a range of accessories, including the UltraDish directional microphone and additional contact probes, to further increase its versatility.

According to Davis the first generation PD instruments established the effectiveness of assessing PD activity using TEV measurement, but were relatively large and expensive. The second generation, started with the UltraTEV Detector, and in 2003 the multi-sensor hand held instruments were introduced.

He claims these devices have dramatically increased the adoption of PD measurement as an asset management technique.

"Third generation products, including the UltraTEV Locator™ and UltraTEV Monitor™, are truly multi-functional systems which provide PD-related condition data and analysis in unprecedented detail."

The UltraTEV Locator™ measures PD activity in cables using a plug-in RFCT sensor. [www.eatechnology.com](http://www.eatechnology.com)



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## OPENING & KEYNOTE SESSIONS



Pandor



Gray



September



Pandey



Ngcaba



Valenzuela



Yeung

### Accelerating Growth and Development

Monday, 24 May 2010 • 8:30 – 9:40

**Naledi Pandor**

Conference Chair  
Minister of the Department  
of Science and Technology  
South Africa

**Steven D. Gray**

Head & Vice President, Corporate Research  
Huawei Technologies, USA

### Accelerating Growth and Development for Business

Monday, 24 May 2010 • 10:15 – 11:30

**Reuben September**

Group Chief Executive Officer  
Telkom, Republic of South Africa

**Ajay Pandey**

Managing Director & Chief Executive Officer  
Neotel, Republic of South Africa

**Andile Ngcaba**

Executive Chairman Dimension Data - Africa  
and Middle East, Republic of South Africa

### Research and Technology for Accelerating Growth and Development

Tuesday, 25 May 2010 • 8:30 – 10:00

**Reinaldo Valenzuela**

Director, Wireless Research  
Bell Labs, Alcatel-Lucent, USA

**Raymond W. Yeung**

Chair Professor  
Chinese University of Hong Kong, Hong Kong

## BUSINESS FORUMS

Monday, 24 March 2010

Mobile Broadband as an Enabler of  
Accelerated Broadband Development

13:30 – 15:00

IMT-Advanced - The Technical and the Strategic  
Landscape for 4G and Beyond

15:30 – 17:00

Alternatives to providing Affordable and Sustainable  
Mobile Broadband in a Fast and Cost Effective  
Manner

Tuesday, 25 March 2010

Regulatory Environment and Spectrum Reform  
– the Key to Growth and Development

11:00 – 12:30

Policy and Funding Models for Accelerating the  
Rollout of Broadband Access and Networks in  
Developing Countries

13:30 – 15:00

Spectrum Management – Technologies, Economics,  
Regulatory Environment

15:30 – 17:00

Challenges in Commercialization of Cognitive Radio  
Technologies

Wednesday, 26 March 2010

Ultra Broadband Technologies

9:00 – 10:30

100 Gbps Networking: Trends, Deployment, and  
Challenges

## TECHNICAL SYMPOSIA

- Ad Hoc Sensor and Mesh Networking
- Communication and Information System Security
- Communication Theory
- Communications Quality of Service, Reliability and Performance Modeling

- Multimedia Services, Communications Software and Services
- Next Generation Networking Protocols, and Services
- Optical Networks and Systems

- Signal Processing
- Wireless Communications
- Wireless and Mobile Networking
- Selected Areas in Communications

## TUTORIALS > Buy one get the second one free! <

- T1: Cooperative Wireless Communications
- T2: Networking Cognitive Radios for Dynamic Spectrum Access
- T3: Broadband Wireless Technologies: LTE and WiMax
- T4: Locality Aware P2P Delivery: The Way to Scale Internet Video
- T5: Energy Efficient Networks
- T6: High Definition Location-Awareness
- T7: Compressive Sensing and Signal Scarcity in Wireless Communications
- T8: Application of Game Theory for Designing Cognitive Radio Networks
- T9: Statistical Delay-QoS Provisioning in Wireless Networks: Effective Capacity and QoS-Driven Resource Allocations
- T10: Planning Wireless Municipal Networks based on Wi-Fi/WiMax Mesh Networks - Applications, Technologies and Business Models

- T11: Femto-cells: Opportunities and Challenges
- T12: Vehicular Networking
- T13: Aspects of Multiuser MIMO-Principles and Standardization in LTE-Advanced
- T14: Understanding Next Generation Mobile Networks (NGMN): The Role of the Evolved Packet Core (EPC) for seamless Mobile Broadband Service Provision
- T15: Multi Gigabit Transmissions at 60 GHz: Standards, Technologies, and Challenges
- T16: Stochastic Geometry and Random Graphs for the Analysis and Design of Wireless Networks
- T17: Recovery in IP over Optical Networks: Challenges and Solutions
- T18: Overview of 3GPP LTE Radio Interface: Layers 2/3
- T19: Security Issues in Dynamic Spectrum Access Networks
- T20: Biologically-inspired and Nano-scale Communication and Networking

## WORKSHOPS

- W1: Smart Grid Communications
- W2: Energy Efficiency in Wireless Networks & Wireless Networks for Energy Efficiency
- W3: Vehicular Connectivity
- W4: Social Networks
- W5: Underwater Networks

- W6: Cooperative and Cognitive Mobile Networks
- W7: Cognitive Radio Interfaces and Signal Processing
- W8: Medical Applications Networking
- W9: IEEE Vehicular Networking and Applications: Future Wireless Technologies for Vehicle Infrastructure Integration (VII) Applications
- W10: Integrated Disaster Risk Management for Africa



Register by 23 April 2010 to receive the reduced registration rate!

## CV fraud is increasing rapidly in South Africa and abroad

More and more people are allegedly resorting to forging their curriculum vitae in an effort to secure a position in the highly competitive market where jobs are becoming increasingly difficult to find, according to Caron Hall of the human resource consultancy TheHRHub.

She says that the tough economic conditions prevailing in South Africa – and in other parts of the world too – are forcing many desperate job seekers to make false claims on their summary of work experience because they so urgently need to secure an income.

She says that CV fraud can take a number of forms including:

- Embellishing the salary they were paid;
- Lying about their criminal record or their credit status
- Embellishing academic qualifications.

Hall says that unfortunately the small and medium-sized enterprises tend to recruit people themselves and do not have the necessary experience to do a thorough background screening because they fear the cost implications of doing so.

Moreover, they seldom use the services of a recruitment company because many of these companies are perceived as being expensive to use and charging high fees.

She points out that one bad decision when hiring a person can have much more serious cost implications for the company.

According to the Risk Advisory Group, at least 53 percent of people lied about their previous job titles in 2008 and 22 percent lied about the educational grades they received.

However, by the end of last year the figures had risen dramatically with 75 percent of all CVs containing at least one inaccuracy – a euphemism for a lie.

According to South African company EMPS' 2009 Annual Screening Report there was a huge rise in CV fraud in South Africa. Of all the applicants screened using either the name or identity number (or both), five percent had a criminal record.

Using the AFIS fingerprinting system to

screen applicants, there was a 14,5 percent positive hit-rate. EMPS says what makes this particularly disturbing is that applicants were convicted for:

- Theft – 28 percent
- Assault – 18 percent
- Criminal road traffic offences – 19 percent
- Fraud – seven percent
- Housebreaking – seven percent.

Equally disturbing was the fact that 40 percent of job applicants with a criminal record were repeat offenders.

People lying about their financial position also increased with 23 percent of the credit checks done on applicants returning a positive listing indicating that their credit record was questionable with bad debts, default judgements or writs of execution against them.

In terms of lying about qualifications, 8,5 percent of job applicants in South Africa had lied about their actual qualifications.

According to Hall, the recruitment consultancies usually conduct in-depth background screening checks and the cost of these investigations are normally included in the placement fees charged. There are also a number of independent screening service providers who will do these background checks for free.

Referring to the risk involved in employing someone and then finding out that they had lied about their past are immense. Greg Brown, executive manager for risk management and compliance solutions at LexusNexus, a business owner cannot delve into a prospective employee's background.

He says an employer can only conduct such investigations if they have received the full consent of the employee to do

so and the investigation being done must be relevant to the position for which that prospective employee has applied.

Only with consent are employers able to verify information contained in an individual's CV, do a credit check with a credit bureau, establish their criminal record status, investigate any road traffic infringements, confirm their academic qualifications and membership of professional associations.

For small and medium-sized companies, these background checks are imperative and invariably the problem is that such background checks are only done a few months after the person has been given the job.

Given the extent of Labour Law in South Africa it can then be very difficult to get rid of the employee and it can only be achieved after a formal dismissal process has been followed.



## Durban's Moses Mabhida Stadium gets HDTV

Foxcom, a global provider of advanced communications solutions for the professional satellite world, recently completed the installation of BsmarTV fibre transmission equipment at the Moses Mabhida Stadium in Durban.

With a capacity of 70 000 spectators and hosting games that will include one of the semi-finals, it is critical that the broadcasting and high definition television (HDTV) quality is not compromised. Recognising that RF-over-fibre-optic infrastructure is the key for superior multimedia broadcasting, Durban stadium organisers proceeded with Foxcom's BsmarTV solution, providing unlimited capacity and uncompromised delivery performance.

Foxcom's BsmarTV products provide transmission and receiving equipment to accommodate a number of broadcasters over a single fibre, which is transparent when changing content providers. The result is a system that effectively transports and manages multiple services and broadcasters over a single fibre into the stadium.

In comparison with traditional copper-based technologies, fibre optic has no bandwidth limitations and can lend itself to almost any type of traffic, analogue or digital. Copper would also require power boosting and connection at every 80 to 100 metres, whereas fibre eliminates the

risk of power failure and delivers a passive transmission along the route of the fibre.

Brad Hall, director of sales for the company says the quality of viewing experience has never been so important with international audiences and worldwide transmission distribution. This is apparent to the Durban organisers and why the choice of infrastructure is recognised as one of the most critical elements of the event's success.

He claims the BsmarTV suite of products installed at the Durban stadium provides a solution that can seamlessly support heightened demand and complexity of transmission during the forthcoming soccer matches, outperforming all traditional alternatives every time.

Foxcom, established by a team of fibre optic experts, has been marketing point-to-point fibre optic connectivity solutions since 1993. These systems continue to demonstrate reliable, high bandwidth point-to-multi-point connectivity, and are an integral part of the infrastructures used by leading international communication companies around the world.

Foxcom delivers signals from a single fibre, allowing providers to deliver more than 2,4 GHz to each tenant. This provides more than enough bandwidth to deliver traditional cable television, Internet access, local off-air UHF/VHF television and security services.

DBS allows tenants to receive 200 or

more channels from a single rooftop satellite. DBS is sometimes known as L-Band, the portion of the electromagnetic spectrum with frequencies between 950-2,150 MHz.

Foxcom has established a local distribution channel with the support of Datanet (a Pinnacle subsidiary) and Ellies, along with a number of appointed system integrators, vendors and other service providers to deliver broadband access to the African market.



Brad Hall, Director of Sales at Foxcom.

## Cree offers new range of amber LEDs

Cree, a market leader in LED lighting, has launched its new 5mm round amber LEDs for transportation signage. This new line of high-brightness LEDs features minimum viewing angles of either 15 degrees or 30 degrees and is designed to meet the stringent requirements of the global transportation signage markets.

The 15-degree high-brightness LEDs offer a minimum intensity of 12,000 mcd. The 30-degree (high-brightness LEDs offer a minimum intensity of 5,860 mcd).

Cree is one of the companies that has turned to LED lighting technology and is hoping that it will eventually replace the incandescent light bulb through the use of energy-efficient, environmentally friendly LED lighting. Cree offers a range of lighting-class

LEDs, LED lighting, and semiconductor solutions for wireless and power applications.

Cree's product families include LED fixtures and bulbs, blue and green LED chips, high-brightness LEDs, lighting-class power LEDs, power-switching devices and radio-frequency/wireless devices. Cree solutions are driving improvements in applications such as general illumination, backlighting, electronic signs and signals, variable-speed motors, and wireless communications.



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## Call for companies to invest in the elderly

The Ambient Assisted Living Forum (AAL Forum) 2010 will be held at the Odense Congress Centre in Denmark in September this year and is the result of collaboration between the City of Odense, the Region of Southern Denmark, the Danish Ministry of Science, Technology and Innovation and the AAL Joint Programme.

This year the AAL Forum focuses on presenting innovative solutions to tackle the challenges inherent to our aging societies. It aims to provide a platform for all stakeholders – investors, researchers, policy makers, industry providers and end-users – to discuss smart solutions for an improved quality of life in later years.

“Never in human history has the senior generation outnumbered the younger generations. Assistive technology is the key solution and a main asset to achieve, or even just maintain, a proper level of service and care for seniors in our societies, as well as to develop new market opportunities for SMEs in Europe”, says Lena Gustafsson, President of the AAL Association.

Ambient Assisted Living Technology is a relatively new and vibrant field of investment, research and development. Policy makers are already exploring options and planning on future technology investments in this area. Several regional and national initiatives are emerging throughout Europe to support public and private investment in this field. In support of this the 2010 AAL Forum will now launch and host the first ever European AAL Investment Forum.

“There are too many promising business cases that never enter the market. The financial situation in Europe is not making it easier for SMEs to access venture capital. This is why we are launching the AAL Investment Forum. We strive to establish direct connection between private and public venture capital and SMEs, and to share market intelligence,” claims Reinhard Goebel, leader for development of the AAL Investment Forum.

The objective of the one-day Investment Forums is to improve communication between investors and researchers and introduce investors to projects which require immediate and/or long term funding. The event will provide a matchmaking bazaar and tailored presentations for investors, software developers and other interested parties.



## Siemens expands its Sitop power supply range

Siemens' industry automation division has expanded its Sitop smart series of power supplies with a 24V unit with 3-phase connection.

The Sitop PSU300S is designed for standard regulated 24V direct voltage requirements for machinery and plants. The new power supply unit with adjustable output voltage from 24 to 28 volts features a wide-range input from 340 to 550 V AC and supplies 20-ampere rated current.

With an overall width of just 100 millimeters and no need to calculate lateral clearance for installation, the primary-switched power supply only requires minimum space on the DIN rail.

Siemens claims the unit has high efficiency of more than 91 percent with a minimum loss of energy and low heat generation in the control cabinet.

The new unit supplies 1,5 times the rated current up to five seconds long for starting up loads with high power requirements. Sitop PSU300S supplies 20 amperes of rated current for ambient temperatures of 0 to 60 degrees and can be operated up to 70 degrees with derating.

At temperatures of less than 45 degrees, the stabilised power supply continuously provides up to 20 percent overload current.

With the 3-phase wide range input of 340 to 550 V AC and international certification, the new Sitop PSU300S can be used all over the world.

Even with extreme voltage fluctuations, the unit steadily provides 24 volts.

Additional Sitop modules are available for increased protection against disturbances from the external network or for 24V circuits, for configuring a redundant or uninterruptible DC power supply, or for selectivity in 24V feeders for example.





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## TelFree offers cheap calls from mobile phones or computers

Staying in touch with friends and business colleagues has become easier and more affordable using the TelFree Mobile and TelFree Web internet applications, that integrate online and offline telecommunications seamlessly, claims Walter Betschel, chief executive of TelFree.

He says there are no subscriptions and no contracts as the services are free, making it ideal for individual users as well as for corporate clients. This is not strictly true because in order to use the service it is necessary to buy some credit.

If you use the basic service the charge for a call to a mobile phone is R2,19 while calls to a fixed line are 99 cents and calls to other TelFree users are 45 cents. SMS services cost 82 cents per message. The same rates apply to the Professional package, but you have to subscribe at a cost of R59 a month. For the Ultimate package you pay R129 a month but your call rates drop to R1,77 for mobiles, 65 cents for fixed lines and calls to other TelFree numbers are free.

However, TelFree charges on the basis of a global flat rate instead of a per minute basis.

"Everybody can have the convenience of communicating the whole communication range from normal phone-calls to chat, email and instant messaging on Facebook ... and all from one device, without having to switch on and off different programs. And all this at low rates - for a high quality service," says Betschel.

To activate data voice calls; threaded SMS; instant messaging and chat on social networks; as well as the sending and receiving of e-mails using push technology (also threaded and key word search optimised); simply download the TelFree Mobile application from the [www.telfree.com](http://www.telfree.com) website to your mobile smartphone, or send "telfree" an SMS to 39642 (SA only).

Then, connect your smartphone to the internet over Wi-Fi or 3G and away you go - instantly, across the globe and with excellent quality to boot.

There is no more need for costly national calls or exorbitant

international roaming fees from mobile network providers either.

"TelFree provides one global flat rate to fixed lines, mobile phones and, even better, is free for registered TelFree to TelFree accounts. It is now possible to call Aunt Peggy in London for the same cost as calling your boss in the next room. Or, if you are already in London visiting Aunt Peggy and can't make it back in time for that meeting at home, you can phone the boss and make his day - for the same price," he says.

To make this possible, TelFree has spent several years investing in software development and carrier-grade quality telecommunications infrastructure.

TelFree's head of research and development, Rapelang Rabana says it is essential for the company to provide superior quality calls significantly better than the current experience of voice calls using internet protocols, as we need to be certain that our technology will deliver what users want.

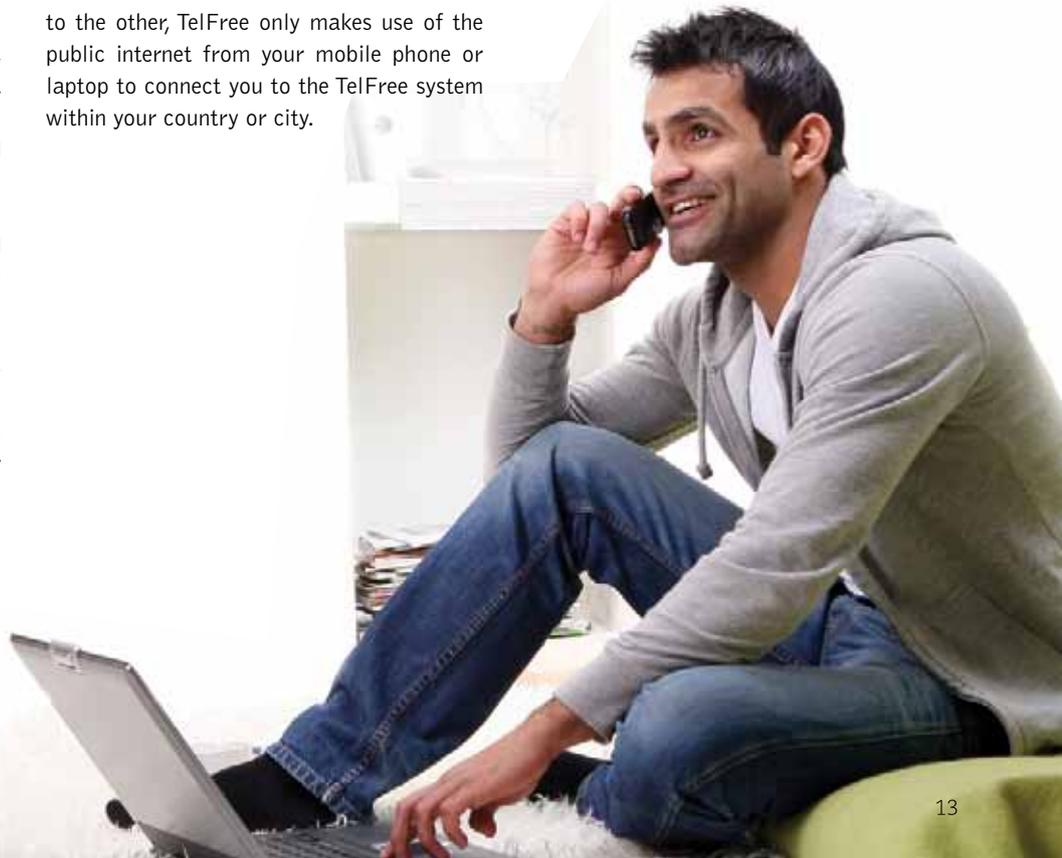
Unlike other internet or VoIP companies that use the open public uncontrolled Internet to deliver the call from one end to the other, TelFree only makes use of the public internet from your mobile phone or laptop to connect you to the TelFree system within your country or city.

Thereafter, TelFree controls and manages the call in much the same way as traditional operators or carriers, ensuring that TelFree delivers total communication that is faster and with better quality than any other VoIP provider.

Further benefits of the TelFree system include a unique 087 number that is fully integrated yet portable, so there is no need to change your existing GSM cell phone number. And, when you are not logged into your TelFree account, you can still receive calls, SMS and emails, as the advanced TelFree technology recognizes that number.

Additionally, TelFree has optimised TelFree Mobile which uses only half the usual required Internet data and therefore saves data costs and uses six times less battery power when the phone is idle.

It is also easy to connect to your social and business network through traditional computers (desktop or laptop). This is done by accessing TelFree Web on the Internet.



# Watt's Going On?

## Landmark naval architecture text update by Vorus

*Principles of Naval Architecture Series: Vibration* by William S. Vorus, and edited by J. Randolph Paulling, is now available in new revised edition.

The reference work is considered a defining work for naval architects and presents the principles underlying analysis of the vibration characteristics of modern seagoing ships and

the application of those principles in design and problem solving.

The classical continuous beam model with steady state response to periodic excitation is presented first. This includes natural frequencies, mode shapes and modal expansion. Discrete analysis is next presented, based upon finite element principles.

Examples are discussed involving analysis of the entire ship and component parts, for example on the deckhouse. The principal sources of excitation are usually the propulsion machinery and the propeller and methods of predicting the forces and moments produced by each are presented. There is a brief introduction to underwater acoustic radiation and sound as it is related to propeller effects.

Attention is devoted to design of the hull and propeller for vibration minimisation. This includes design of the ship after body and appendages to ensure favourable wake characteristics, tip clearances and selection of propeller characteristics such as number and shape of blades.

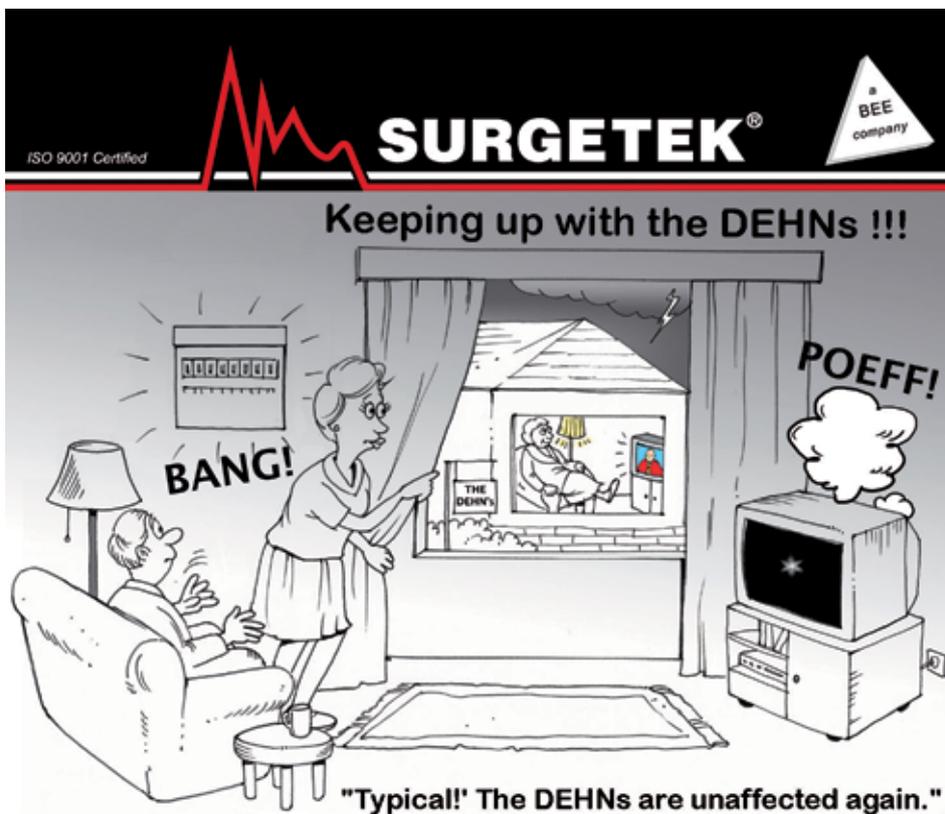
There are sections on vibration surveys, sea trials, acceptable vibration standards and criteria. Concluding sections treat methods of remediation of vibration problems that are found after the ship is completed, including modifications to propeller design, structure and machinery.

William S. Vorus is the Jerome Goldman Endowed Academic Chair in Naval Architecture and Marine Engineering at the University of New Orleans, where he is also school chair. Vorus is a 1963 graduate of Clemson University and received his MSE and PhD from the University of Michigan in 1969 and 1971 respectively.

In 1973 he left industry for a faculty position at the University of Michigan, where he achieved the rank of full Professor in 1983. He joined the faculty of the University of New Orleans in 1996. He was the 2009 recipient of the Society's William H. Webb Medal.

The Society of Naval Architects and Marine Engineers is an internationally recognised non-profit, technical, professional society of individual members serving the maritime and offshore industries and their suppliers.

Founded in 1893, the Society comprises over 8 000 individuals throughout the United States, Canada and abroad. Membership is open to all qualified applicants in or associated with the maritime, offshore, and small craft industries.



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S60b

WATTnow

## Applied mathematician receives prestigious regional fellowship

Applied mathematician, Ms Sonia Woudberg, at Stellenbosch University is one of five recipients to receive the inaugural L'Oréal and UNESCO Regional Fellowships for Women in Science in sub-Saharan Africa, worth \$20 000.

Her research helps to bridge the gap between advanced mathematical analysis and practical engineering problems, and helps to ensure the absolute correctness of calculations being made in the planning and construction of engineering projects.

The prestigious fellowships form part of L'Oréal Corporate Foundation's continued investment in women in science.

The five recipients were chosen for their remarkable achievement and promise in scientific research by a jury of six professors from countries within the sub-Saharan Africa region. Four of the judges are Laureates of the prestigious international L'Oréal-UNESCO Award.

Ms Woudberg is a doctoral student in applied mathematics at Stellenbosch University, and is also a lecturer in the Department of Mathematical Sciences.

During her academic career Ms Woudberg has received more than 20 prestigious bursaries, grants, scholarships and other awards, has published and presented widely, and has represented Stellenbosch University at various national and international conferences and symposia.

The L'Oréal and UNESCO Regional Fellowship for Women in Science in sub-Saharan Africa gives Ms Woudberg, a lecturer and doctoral student in applied mathematics, a major boost to complete her doctoral thesis. Her work focuses on a comparative analysis of predictive equations for transfer processes in different porous structures.

Ms Woudberg is part of a research group in flow modelling led by Prof Prieur du Plessis in the Department of Mathematical Sciences: Division Applied Mathematics at Stellenbosch University. They mathematically formulate equations and continuously improve existing equations to predict how fluids and gases such as water,

wind and oil flow through porous materials like rock beds, buildings, coral reefs, woven fabrics and sand.

Mathematics, computer programming and available experimental data are some of the valuable tools she works with.

By bridging the gap between advanced mathematical analysis and practical engineering problems, the research group helps ensure the absolute correctness of calculations being made in the planning and construction of engineering projects.

"The fact that physical flow processes in different types of porous media can be predicted eliminates the need to perform a vast number of extremely expensive and time-consuming experiments," Ms Woudberg explains.

Ms Woudberg is one of two South Africans to receive the Fellowship. The others include South Africans Kgaogelo Amanda Maswanganyi, Nigeria's Ndidi Ngwuluka, Nonhlanhla Mkhize from Swaziland and Cameroon's Pascaline Fonteh.

The Regional Fellowships, organised in conjunction with African Network of Scientific and Technical Institutions (ANSTI), are a three-year pilot programme, which aims to recognise and assist the women to undertake important scientific research in their chosen fields.

The L'Oréal Corporate Foundation is dedicated to recognising the importance of women's contribution to scientific research and assisting them in their role in the future progress of science. To this end, they developed the For Women in Science partnership with UNESCO, which since 1998 has helped distinguished eminent women researchers throughout the world and supported doctoral and post-doctoral women in the pursuit of their careers in science.

The addition of the Regional Fellowships for Women in Science in sub-Saharan Africa is another major step in confirming the commitment of the L'Oréal Corporate Foundation to scientific research and brings to the African continent all the benefits of the L'Oréal-UNESCO partnership.

Beatrice Dautresme, vice President of L'Oréal and chief operating officer of the L'Oréal Corporate Foundation, emphasised their commitment to the project saying that the organisation is acutely aware of the scarcity of women in scientific research.

For this reason, since 1998, the L'Oréal-UNESCO For Women in Science partnership has been striving to counteract this under-representation, by highlighting women as role models in the sciences and by supporting the vocations of promising young women.

"Through the creation of this new Regional Fellowship programme, we aim to help young African women pursue their scientific vocations at a critical time in their professional lives," Ms Dautresme says.



Ms Sonia Woudberg.

# Department Of Electrical, Electronic and Computer Engineering



UNIVERSITEIT VAN PRETORIA  
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The Department has been (and still is) one of the largest engineering departments in the country; with three undergraduate accredited degree programmes in electrical (heavy current), electronic (low current) and computer (information, communication and telecommunications) engineering.

These subjects are all backed by extensive post-graduate and research activities in the cutting-edge sub-fields of the three main disciplines. The Department is the home for a number of centres of excellence and institutes, such as CEFIM, CeTEIS, CEM, CNES, EE and DSM Hub and endowed chairs such as the Sentech and Grintek Chairs.

National hub for the Post-graduate Programme in Energy Efficiency (EE) and Demand Side Management (DSM) - EE and DSM hub

The University of Pretoria has been awarded the privilege and responsibility to host the South African National Hub for the Postgraduate Programme in Energy Efficiency and Demand Side Management by the South African National Energy Research Institute.

The official launch of the Programme took place in June 2008 at the University of Pretoria.

The postgraduate research programmes are aimed at attracting a large number of qualifying under-graduates from across the country, as well as an increasingly strong contingent of international students. The University of Pretoria has established post-graduate degree programmes specialising in energy efficiency and DSM.

Analytic techniques from engineering and optimisation are the main tools in the quantitative study of energy efficiency related topics such as power system scheduling, power system efficiency with alternative energy resources and co-generation, motor and transportation efficiency, fuel efficiency, and energy efficient architecture and housing.

The study extends to demand side management schemes, smart load control and computer networks, and energy efficient lighting.

These research topics are clustered among different research groups across a number of

departments within the University of Pretoria. The topics include:

- Power and energy systems.
- Industrial electronics.
- Electric drive and transportation.
- Control and computer network systems.
- Solid state lighting.
- Process integration in chemical engineering.
- Fluid dynamics and heat transfer in mechanical engineering.
- Architecture and housing.

The Director of the Energy Efficiency and Demand Side Management Hub is professor Xiaohua Xia, who joined the Department as a Professor in Control Systems in 1998. He received the PhD degree from Beijing University in 1989.

Over the past 12 years, Prof. Xia has completed over 26 funded research projects, of which 18 have been awarded, all with him as the principal researcher, with a total funding exceeding R30 million. He has been extremely successful in attracting inter-governmental funds, once from the Swedish/RSA, once from the UK/RSA, twice from the Sino/RSA and thrice from the Franco/RSA scientific agreements. Prof. Xia has published over 130 research papers. Most of his publications are of the highest quality, published in the most reputable journals and conferences in the field. Prof. Xia is honoured as an IEEE fellow, the highest grade of membership of this largest professional organisation in electrical, electronic engineering, as well as an NRF A-rated scientist.

He has been awarded as an outstanding academic achiever from the University since 2004. He was elected a fellow of the South African Academy of Engineering in 2005. He has been nominated to chair the Technical Committee of Nonlinear Systems -- one of the most important specialised TCs. He was also invited to sit on the Technical Board -- the highest technical decision making body in IFAC.

A typical example of the research done by the HUB is the industrial energy optimisation platform and its applications in industrial energy projects:

### Project 1. Optimal Control of the Conveyor Belt Systems of a Colliery

The energy usage and planning of conveyor belt systems of mines are optimised. Constraints such as the loading capacities of conveyor

belts, stock piles, production requirements and electricity tariff structures are included in the optimal control model. The obtained optimal controller potentially reduces the cumulative active energy costs of a conveyor belt by up to 49%.

### Project 2. Optimal Load Management for a Rock Winder System

The right rock winder system from a gold mine consists of winders and conveyor belts. The aim of the project is to minimise energy cost of the rock winder system in terms of time-of-use tariff and maximum demand charge. Production targets, physical system constraints, possible delays, tariff structures and the total energy usage and costs are parameters to achieve trade-offs of different issues.

### Project 3. Optimal Scheduling of a Pumping System

A water pumping system in a water supply system is studied. By combining the constraints of reservoir capacities, water demand, time-of-use tariff, voluntary load shedding requirement, an optimal pumping scheduling plan is found and up to 50% load can be shed in peak time and 12% electricity consumption is achievable. Maximal demand charge and the potential of the Market Participation Programme can also be studied in the model.

The HUB is also investigating sustainable, energy-efficient lighting through the use of Solid State Lighting.

### Project 4. Optimal use of High Brightness Light Emitting Diodes (HB LED's) for retrofit lamps and new luminaire designs

Lighting currently constitutes approximately 20% of all electrical energy consumption in the world. Through projections it has been calculated that the world can save 125 GW of generating capacity by 2025 through LED lighting.

However, luminous efficacies of more than 150 lumen/Watt for production HB LED's (with good colour appearance and good colour rendering), must be achieved by 2015 to make this possible. Luminous efficacies of 200 lumen/Watt have already been achieved in laboratories.



For more information, please visit:  
<http://eehub.up.ac.za/>



## TomTom offers live road condition information

TomTom, one of the world's leading providers of location and navigation solutions, has launched two new traffic solutions designed to help government agencies better manage traffic flows and to enable them to provide better traffic information to the public.

HD Flow and HD Route Times are based on TomTom's High Definition Traffic technology, an advanced service for TomTom end users that delivers up-to-the-minute, detailed incident reports about the length and reason for delays, accurate delay information, travel and arrival times and alternative route proposals.

TomTom is the authority in traffic information with a strong history of providing up-to-date and accurate traffic information to consumers, claims Anne van Houwelingen, senior vice president of mobility solutions at TomTom.

She says these two new solutions build on the company's expertise and are ideal for systems designed to provide travel times on alternative routes and provide information based on optimal routing and traffic flow efficiency during road work.

"In addition, government institutions and road construction companies can leverage the precise real-time information to gain better control of their road networks and keep drivers fully informed along the way on a day-to-day basis," she says.

HD Flow delivers a real-time, highly detailed view of how all traffic is flowing on the road network delivered in Europe to ensure easy integration into existing systems. Local authorities can integrate this real-time flow information into their traffic control centres to better monitor road

network traffic and see the effects of traffic management directly on all motorways and secondary roads.

HD Route Times is a turnkey solution providing precise, real-time travel and delay times for all possible routes, giving local authorities the dynamic information needed to update variable messaging signs (VMS) along key routes. As the data is updated every minute, drivers are provided with an insight into which route is fastest at any given moment. As a result it can help drivers select a faster route, which in turn optimises traffic flow.

Real-time speeds are provided on all motorways and secondary roads, giving the most accurate view of the traffic situation across the entire road network. Both products are quick and cost efficient to implement. They do not require additional infrastructure or hardware installations.

HD Flow and HD Route Times are now available for government entities with initial coverage available for Germany, the Netherlands and Switzerland for all motorways and secondary roads. Coverage for additional countries is scheduled to be added in the course of 2010. Cross border traffic information is also included in the offerings.

HD Traffic, HD Flow and HD Route Times

contain up-to-the-minute information from multiple data sources, including anonymous GPS measurements from connected personal navigation devices, connected fleet GPS devices and mobile phone signals, road sensors and journalistic data.

Using proprietary and tested methods, TomTom dynamically merges this information and makes it available in real time to industry customers in the personal navigation, cell phone, fleet management, local authorities and in-vehicle markets.

HD Solutions can be incorporated into navigation solutions or routing tools to help drivers be automatically rerouted around jams and potentially save time and money, minimise environmental impact, and enjoy a significantly improved navigation experience.

TomTom is based in the Netherlands and employs more than 3 000 employees worldwide. More than 40 million people use TomTom devices every day, in the form of dedicated portable navigation devices (in-dash car systems or tracking and tracing solutions for fleet management). In addition, hundreds of millions of people use TomTom's digital maps on the internet or their mobile phones.

In 2009 TomTom reported €1,5-billion in revenue and a €340-million net cash flow from operational activities.



# Earth Wire Monitor – EWM550

Profit and production are the key to your success.

However, if these are to be achieved by compromising on safety, then best you reconsider your business model.

The EWM550 is a unique device offering you increased peace of mind in the most hostile of operating environments.

It works with the electrical supply system to monitor and alert you to a deterioration of the earthing system allowing you to react before your production is affected – but protecting your plant and personnel in the case of a dangerous condition developing.



## Features

- ▶ Continuous monitoring of earth bond integrity.
- ▶ Connects to 400/525V 3-phase system.
- ▶ For safety the maximum energy available at the local earth is 380/525V limited to 0.3 Joule / pulse.
- ▶ Three different trip times and levels available for discrimination.
- ▶ Able to withstand failure of one phase or 50% supply voltage.
- ▶ LED indication for trip condition, also when power is off.
- ▶ Totally solid state, shock-proof: no moving parts.

# Eyjafjallajokull continues to spew ash

Tons of yellowish grey ash from a volcano in a remote part of Iceland have been spewing into the Earth's atmosphere grounding flights across Europe and leaving hundreds of thousands of passengers stranded around the world.

Moreover, some of the hills around Hjorleifshofni, south-east of the still-erupting volcano, are covered with the grey ash coating while at a farm in Seljavellir, close to the glacier that was blown apart by the eruption, rescue workers have been shovelling heaps of black ash off the roofs of the buildings.

Seljavellir is situated on a rugged stretch of the north Atlantic coast and is famed for its bird life and glacier-fed waterfalls. However, the entire region is now covered by the powdery substance that contains many harmful minerals including silica and fluoride.

Animals have been kept inside barns across many farms in Iceland to protect from the harmful effects of the powdery ash that is raining from the sky. According to Teitur Arason, a meteorologist at the Icelandic Meteorological Office, the ash could keep spewing from the volcano for months.

The ash cloud extends from 2 000 metres to about 11 000 metres into the atmosphere and the predicament for airlines is any jet flying through the ash cloud could suffer catastrophic engine failure.

The International Air Transportation Association has slammed European governments for closing all airports and prohibiting any planes from taking off or landing. It says the global disruption of flights is costing the travel industry about \$250-million a day.

Various airlines, including Air France, Lufthansa and KLM maintain that it is actually safe to fly after they conducted several test-flights across Europe to assess the likelihood of engine damage.

However, a senior officer with the North Atlantic Treaty Organisation (NATO) confirmed that a build-up of glass was found in the engine of a NATO F-16 fighter jet after it was used during a military exercise shortly after the eruptions started.

The Royal Navy's aircraft carrier Ark Royal and two assault ships, the Ocean and the Albion have been sent to harbours in Europe to assist an estimated 200 000 British travellers to get back home following the blanket ban on all flights out of most European countries.

The World Health Organisation has warned European and British residents to stay indoors to avoid the ash as it falls from sky because it contains many toxins minute amounts of silica in the ash could contribute to widespread respiratory problems or permanent lung damage.

According to WHO spokesman David Epstein, people may find they have itchy or irritated eyes, a runny nose, a sore throat or a dry cough and will notice the awful smell associated with rotten eggs that is an indication that large amounts of sulphur are in the air.

The ash cloud is invisible from the ground. Epstein says that people who have to go outside should wear a mask to protect themselves. He says that WHO has not yet established how serious the health risks are but will be testing batches of ash to discover what the powdery substance contains.

A volcanologist at the University of Iceland, Armann Hoskuldsson has been observing the volcano and says that the levels of magma under the volcano appear to be decreasing as the heavy pulsing and violent explosions immediately after the first eruption have actually started to decline.

The eruption is taking place under Iceland's Eyjafjallajokull glacier, normally a popular hiking ground situated about 120 kilometres from the country's capital Reykjavik. The last now eruption of this volcano occurred about 200 years ago and it apparently kept spewing the black and brown ash into the atmosphere for almost two years.

Iceland sits on a volcanic hot-spot in the Mid-Atlantic Ridge and has had relatively frequent eruptions but these have occurred in sparsely populated regions, posing little danger to people or property.

There are fears that the small earthquakes deep inside the Eyjafjallajokull volcano could trigger a major eruption the much larger Karla volcano almost 13 km away below the Myrdalsjokull glacier.

Geologist, Sigurhunn Hainsdottir of the University of Iceland warns that if Karla were to erupt it would cause considerably more disruption than the Eyjafjallajokull eruptions.

She says the eruptions could continue for months. Volcanic eruptions occur quite frequently in other parts of the world but mostly in remote regions where the damage to people and the environment is limited.

The Red Cross has opened mass care centres across Iceland and has advised people who do go outdoors to wear masks and goggles for protection. About 450 people, mostly farmers, have been evacuated from the remote region where the Eyjafjallajokull volcano is situated.



# South Africa's position in Nanotech

*Nanoscience, the study of the properties of materials typically in the range of between one and 100 nanometres (nm), and nanotechnology, the use of the new properties discovered by nanoscience, are the future bones of materials development – and perhaps much more. As a reminder, a human hair is 100,000 nm wide, a red blood cell is 10,000 nm in width, while DNA is four nanometres wide.*

South Africa, in the form of the Department of Science and Technology (DST), has invested in the future of this field, through the establishment of nanoscience and nanotechnology hubs. The DST granted funds to equip these hubs and for the development of human resources in this field.

One of these hubs formed in 2007 is at Mintek's Advanced Materials Division in Johannesburg; the other is at the CSIR in Pretoria. Mintek has been involved in this field for almost a decade. This stems back to the AuTEK programme, initiated in 2000 and backed by the country's three major gold producers, AngloGold Ashanti, Gold Fields and Harmony, to support the beneficiation of gold.

Each company sponsored a different area of gold related research. Anglo Gold Ashanti sponsored research into the use of gold in catalysts and Mintek has reached the point where commercial gold-based catalysts are produced in-house. Harmony sponsored the biomedical applications of gold (aimed at producing gold-based compounds for anti-TB, malaria and cancer applications) and Gold Fields sponsored research into the use of gold in nanoscience and nanotechnology.

The head of Mintek's nanoscience and nanotechnology group, Dr Robert Tshikhudo, says that research has achieved the proof of concept stage for rapid diagnostic tests that can detect the presence of diseases such as TB. "We are now using real samples, but of course

would need extensive optimisation before a product is ready for commercialisation." The holy grail is a multi-sensor that can detect in vitro (i.e. non invasively from a saliva sample) a series of diseases and which is cheap and simple enough for anyone to use at home.

Mintek produces various metal nanoparticles on a semi-commercial basis, including colloids, monolayer protected clusters (MPCs) and bioconjugates and also offers custom conjugation. One of the aspects of noble metals, such as gold, at nanoscale level is their optical properties (they absorb and scatter light). When attached to biological molecules such as proteins, they can be used for various biological and pharmaceutical applications including point-of-care diagnostics and therapeutics.

Through the establishment of the DST/Mintek Nanotechnology Innovation Centre (NIC), the research at Mintek now focuses on unlocking the properties, structure and performance of various nanomaterials, including clays, metals and metal oxides.

Nanotechnology is a young field and thus has a vast and wide open terrain. Tshikhudo observes that nanoscience is in that way comparable to what general science was like once upon a time. It is simply science and technology at a nanoscale, and involves chemistry, biology, physics and even some engineering.

With nanotechnology being a vast field, Mintek's mandate is to look at specific areas which are deemed to be particularly relevant to South Africa. Its mandate also takes into account that as an organisation Mintek is more focused on applied than fundamental research.

However, Tshikhudo says that the field is so new that some of the research Mintek is undertaking can be considered fundamental research and it is supporting three higher education institutions to do mandated research. These are Rhodes, the University of Johannesburg and the University of the Western Cape. "Part of our mandate is to develop the human capital in this field." In essence, Tshikhudo is saying that before Mintek can cherry pick research projects to develop further into potentially commercial products, it first has to help create the pool from which these projects will come. Mintek has also sent people to collaborate with the world's leading experts.

The Mintek nanotechnology centre currently has a full staff of 16



scientists, 13 of whom have PhDs, with the remaining three having MSCs. Most of these have a chemistry background. By the end of 2010 the number of researchers is expected to have reached 20, and most of the researchers come from the Mintek bursary pipeline. The DST/Mintek NIC currently has more than 50 postgraduate students registered at various universities in the country.

The areas upon which Mintek is focusing (such as the fabrication of nanotechnology related electrochemical sensor device prototypes; optical diagnostics to develop rapid diagnostic tests for diseases; the development of a nanotechnology based solution to detect and destroy pollutants and pathogens in water; and targeted drug delivery systems) are more challenging than those from which we have seen the emergence of the first wave of nanotechnology related products.

Most of the nanotechnology products to reach the market thus far have been the result of nanomaterials used in fairly simple applications, mostly as particles added to change or enhance certain properties of materials. This has seen nanoparticles used to make sports equipment stronger and more flexible, their application in cosmetics to enhance the colour of products such as lip gloss, their application to create self-cleaning fabrics and the use of silver nanoparticles in anti-microbials.

Dr Suprakas Sinha Ray, chief researcher and leader at the National Centre for Nano-Structures Materials (NCNSM) at the CSIR says, "Within five to 10 years, sophisticated electronic devices that use nanoscale circuitry and memory can be expected. After 10 to 15 years, the introduction of pharmaceutical products, drug delivery and health-monitoring devices will begin."

Because of the diversity of nanotechnology's focus it almost seems too vague a concept to describe a vast field, but Manfred Scriba, senior research scientist at the NCNSM, says that nanotechnology will definitely survive as an umbrella for this field of science and technology development.

One of the big reasons is that nanotechnology research requires very specific equipment. While, as Tshikhudo suggests, in one way it is like science in the old days, sadly you are not going to do much nanoscience in your garage with a welding torch, a spittoon and an optical microscope. Scanning electron microscopes (SEMs), atomic

force microscopes (AFMs) and transmission electron microscopes (TEMs) are some of the basic tools required.

A SEM is used to focus an electron beam which is scanned over a specimen. For each scan position detectors measure the intensity of electrons scattered from the specimen and the resulting image can be displayed on a screen.

An AFM can be compared to a blind person using a stick to feel bumps in a path. The AFM uses a minute tip to scan the surface of a specimen while recording its contour using a laser that reflects off the tip and onto a position detector.

With a TEM, an electron beam passes through a very thin sample on a carbon film. The 'transparency image' is formed on a phosphor screen or captured on a digital camera.

The requirement of specialised equipment is part of the reason why nanotechnology research is being boosted by support from government, and the centre at the CSIR, where the equipment is open for usage by any parties at what Scriba describes as a reasonable cost.

The equipment at the NCNSM includes: a polylab rheomixer for polymer nanocomposites preparation; a compression moulder; a spin coater; various centrifuges and sonicators; a precisely temperature-controlled hot-press; a vacuum oven; a four-probe electrical property measurement facility; an AFM; a scanning tunnelling microscope (STM); a nanolog spectrofluorometer; a Raman spectrometer; a temperature modulated differential scanning calorimeter; an ultra-high resolution thermogravimetric analyser; a dynamic mechanical analyser; a complete set of rheometer equipment; small angle X-ray scattering; wide angle X-ray diffraction; an ellipsometer; an FT-IR spectrometer with IR imaging; and an UV/VIS spectrophotometer.



Henry du Preez graduated with a BSc Electrical Engineering from the University of the Witwatersrand and then earned his Master in Business leadership from the University of South Africa. He also holds a GED Electrical Engineering and a Government Certificate, electrical and mechanical.

Du Preez has more than 48 years' experience in the heavy engineering industry and in the mining sector and specialises in electrical machinery and transformers. He is a fellow of the South African Institute of Electrical Engineers.

He has worked as an engineer in the mining and construction sectors and has extensive experience in maintenance and consulting work where he has been active for the past 18 years.

For 16 years Du Preez worked within the repair and service sector specialising in large AC and DC machines and transformers. For 12 years he has run his consulting service within the electrical and mechanical sectors mainly focused on repairing, testing and servicing transformers, AC and DC machines and rewinding of large generating equipment.

He has produced a number of presentations and papers for numerous technical conferences and regularly attends technical conferences in South Africa and abroad. He has visited a number of companies in Europe, America, India and Japan.

Currently Du Preez provides services to companies in South Africa and in other parts of Africa as well including Uganda, Kenya, Mali, the Democratic Republic of Congo, Namibia, Botswana, Zambia and others.

## Motor management

"Power shortages, sky-rocketing electricity costs and ever-increasing fuel prices are playing havoc with the industry that rely on electricity and as a result, electricity has to be used as efficiently as possible," he says.

"This means that it is essential for companies to use motors that are not only highly efficient but are more cost effective. This is particularly important when motors are repaired or, if it is not worth the cost of repairing them then a high-efficiency new machine makes a more sensible investment for any company that requires it," he adds.

"How do you measure efficiency in motors? How do you ensure that only those motors with acceptable efficiency levels are repaired? Can high efficiency motors be repaired?" asks Du Preez.

He says that efficiency, proper maintenance and high quality repair services are important factors that influence the total cost of ownership of any motors. As a result, Du Preez is now offering a specialised training course that will give people a basic understanding of the operation of AC and DC motors and the factors that assist in obtaining the best, most

economical performance from these motors.

The training course will cover the selection, installation, maintenance, repair and efficient operation of electric motors. "Considering that up to 70 percent of electricity in South Africa is used to power electric motors of one form or another, it's essential that these motors are kept in good working order," he says.

## Transformers

The history of transformers can be traced back to the early 1880s. A transformer is a static piece of equipment with complicated electromagnetic circuits. But they are also an essential part of the distribution and use of electrical energy.

"The transformer has proved itself to be a remarkably reliable and efficient piece of equipment provided that it is correctly selected and maintained," he says.

"And basic theory of the transformer makes a good starting point when selecting the right transformer for a particular application," he says.

Du Preez emphasises that testing and maintenance are critically important for transformers to work properly over a sustained period and therefore these essential elements are covered comprehensively in the transformer training course.

If required, special features and design elements can be included in the course provided there is enough interest and support from delegates wanting to attend this course.

## Henry du Preez Training Program

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though it has outsourced control of some of its research to the three universities mentioned. In contrast the CSIR has kept its bursars on site. Mintek does have an ISO3 level clean room, which the NCNSM does not have.

Unlike Mintek, the NCNSM at the CSIR is more focused on fundamental research. It has eight permanent staff, 12 PhD and four MSc candidates, as well as two post docs and four interns to undertake this research. One of its focus areas is low dimension systems. That means materials of unusual structure that at nanoscale tend towards less than three dimensions in effect. Thin films are two dimensional, rods and wires are one dimensional and quantum dots are seen as having zero dimensions.

One of the breakthroughs over the past three years has been in the ability of the NCNSM to reliably produce single layer nanotubes through a laser ablation process. Carbon nanotubes are much better electrical conductors than copper, behave like metals or semiconductors, conduct heat better than diamond, and are a hundred times stronger than steel while being a sixth of the weight.

Another NCNSM focus area is the production of advanced engineering materials, which through the addition of nanoparticles can achieve improved material strength, and features such as transparency without losing any mechanical properties. This takes into account the very high proportion of a surface area to total material volume at nanoscale. If such nanoparticles are well dispersed through, and bond with, the materials to which they are added, this enhances the structural strength of these materials.

An application is in polymers (plastics), which are carbon-based molecular chains. By themselves these polymers are quite soft. To gain strength, minerals and fibres can be added as filler. The polymer sticks to the filler particles to gain the composite strength, but the interfacial surface area for this sticking is relatively small. Thus, for a strong plastic, 20% or more of its weight must be filler.

The interfacial surface area of nanoparticles is much bigger. Furthermore in nanoclays, due to similar sizes, a single polymer can find itself between two nanoparticles. This highly strengthening phenomenon is called intercalation. When nanoparticles are used, only 1% of filler creates a plastic many times stronger than when using microcomposites. The resulting polymer is also more flexible and can withstand higher temperatures.

Interesting results can also be derived from quantum dots. A quantum dot is a semiconductor with nano dimensions (< 20 nm). Due to its small size, the electrons behave differently when excited by photons or electrons. When excited, an electron/hole pair is generated which is confined in all three dimensions, which results in properties between those of a bulk semiconductor and single molecules. This quantum effect links the particle size to the colour (energy) of the light emitted. This may lead to applications in the development of low energy LEDs.

In all, there has been great progress in producing a variety of nanoparticles and these are becoming available more cheaply than was the case a few years ago. It is these building blocks that will be used creatively in different applications.

Scriba highlights an example where, at the University of Cape Town, doped silicone nanoparticles, some five to 50 nm in diameter,

have been incorporated in an ink and used to print electronic devices such as transistors and resistors on paper.

Another is a capsule for TB drug delivery. The idea is to deliver the drug in a small plastic ball about 100 nm in diameter. This ball will slowly release the medication so that only one dose a week is needed as opposed to a handful of drugs a day. This will help increase compliance and reduce the build-up of resilience of the disease to drugs.

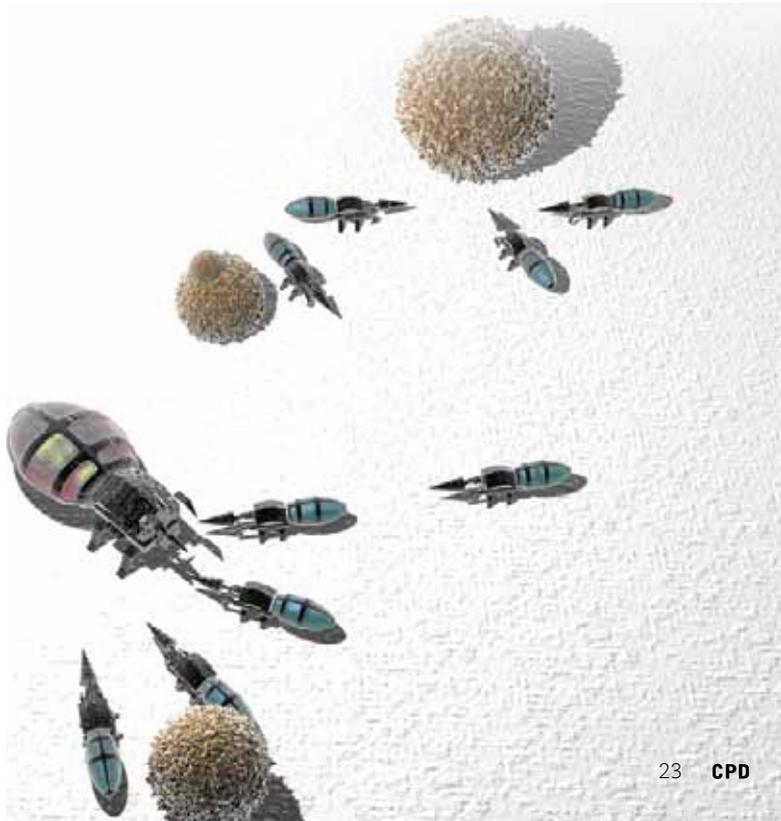
There is collaboration with the private sector, with the carbon nanotubes produced at the NCNSM used to support the development of new catalysts by Sasol.

Scriba says the next breakthrough could be the use of nanotubes and nanorods as a semi-conductor material in highly integrated circuits. The application of nanomaterials in the automotive industry is also expected to gain momentum as the movement is towards more plastics, lighter materials that have the strength to withstand impacts and bounce back into shape.

The commercial culmination of the South African focal points of water remediation and nanosensing are probably some decades in the future, but based on the number of papers being published out of South Africa, its researchers are at least part of the vanguard in this field.

At the same time the facilities are now in place in South Africa to forward research and applied research in this field. In fact, Scriba encourages industry to approach the NCNSM with their suggestions and directions for research as it is better for this to be guided in collaboration with industry than for it to operate in a vacuum.

The resources at the CSIR and Mintek have been created and it would be a tragedy if these were not utilised to their full capacity. It takes into account that while the overhyped talk of self-assembling nanorobots is mostly gone, nanotechnology is the area that has seen the biggest number of patent applications globally over the past five years.





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# GREENEX 2010

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- Economic Developers
- Energy Officials
- Academic Groups
- Utilities



# Africa faces an energy time bomb unless action is taken now

African countries have reached a crossroad in energy development and will have to seek a number of innovative solutions if they want to provide enough energy for the millions of people – particularly in rural areas – who currently have no access to electricity at all.

This was the strong message from speakers at the Energy Indaba held in Johannesburg at the end of February. And the biggest problem that Africa faces is raising the funds to put in the generating capacity and the distribution networks that will be used to get power to the people.

The ideas are there – for a whole range of energy solutions that include renewable energy projects, hydro-electric schemes, wind farms, power generation from landfill sites, solar concentrated thermal power and even simple photo voltaic projects.

Arthur Hanna, of Accenture says that the energy trends can be separated into the geo-political issues, which include:

- Energy and regulatory policies;
- Subsidies;
- Environment and climate change;
- Governmental and security issue.

The Energy industry itself comprises the oil and gas supplies in Africa and the refining capacity and margins along with the technological development and the performance of individual companies.

The Macro-Economic factors applying to Africa include economic development, commodity prices, oil and gas demand and the financial market effects on the future of the continent.

From a South African perspective, a survey by Accenture indicates that 95 percent of the respondents are concerned about the impact of climate change and 97 percent say that it will have a direct impact on their lives. The question is what are they doing to change it – and more succinctly is there any government programme that will have a more dramatic impact on green house gas emissions?

According to Accenture's research, 90 percent of South Africans would be prepared to switch to a new energy provider if this would help to reduce carbon emissions. In essence that makes the outlook

for renewable energy suppliers particularly positive.

However, the reality is different since pricing becomes a key factor and Eskom currently controls the electricity grid, the bulk of the distribution and the bulk of production.

Africa, it seems, is taking some real corrective action on its own carbon emissions and a case study presented by Accenture on biofuels in sub-Saharan Africa shows:

- Mali is involved in a large-scale rural electrification project using jatropha oil to power generators that are installed there;
- Nigeria is producing ethanol from cassava;
- Kenya has plantations of jatropha growing now and it hopes to produce 207-million litres of biofuel this year;
- Malawi has legislation in place to convert to biofuels and has set a goal to produce 47-million litres of biofuel by the end of this year;
- Zambia is using just 15 percent of the 25-million hectares of arable land for farming and there is strong government support in that country to plant jatropha as a biodiesel crop;
- Mozambique has already made a significant investment in projects to produce and refine biofuels although only five million of the 36-million hectares of arable land are currently being farmed. It plans to produce 57-million litres of biofuel this year.
- South Africa says its target is to produce 400-million litres of biofuels by 2013 even though maize has been excluded from ethanol production because of food security concerns. South Africa says biofuel production will create about 25 000 jobs in the country.

Worldwide, vehicle manufacturers are focusing much of their future development on new hybrid vehicles or engines that can run as efficiently on biofuels. Since 1998 31 models that use hybrid or biofuels have been launched in the United States and there are currently more than 1 500 locations where biofuels are commercially sold.

The vehicles available to run on biofuels include models from



Daimler, Chrysler, Ford, General Motors, Nissan and Toyota while, in Brazil 35 models have been produced or adapted for biofuels since 2003 and 86 percent of all cars there can use biofuel. Apart from the models mentioned, there are also vehicles from Citroen, Fiat, Renault and Volkswagen.

Europe has lagged behind other countries with 10 models introduced since 2001 and it's only now that European Union countries are starting to take the use of biofuel more seriously. Much the same scenario applies in Asia and Africa but that picture is likely to change in the future, as more biofuel models are made available.

However, South Africa has invested millions in developing its own, locally produced Joule model that is due to go on sale within the next couple of years. It will be costly but it offers an electric power train that is extremely advanced and sufficient to provide a solution for most commuters in main centres around the country.

Accenture's research shows some interesting features though:

- There has been a 40 percent improvement in the yields from sugar cane and corn since the 1980s and new technologies such as artificial photosynthesis, algae biodiesel and aspects of synthetic biology are contributing to creating the third generations of biofuels;
- There are likely to be at least 16 biofuels plants operating around the world by the end of this year and between them will be producing about 1,1-billion litres of fuel. There are also projects underway in some of the developed countries to build electric charging spots into parking locations and create battery exchange stations for electric or hybrid vehicles.
- Multiple new biofuel production methods are in different stages of development with ExxonMobil leading the way in providing hydrogen fuel cells for vehicles. The United States estimates that it will have hydrogen refilling stations throughout the country within the next ten years even though it costs about \$500 000 per station to adapt it to hydrogen.
- Several European countries are also looking at establishing hydrogen highways with refuelling points that run from Denmark to the Mediterranean.

That's fine in terms of biofuel production, but in Africa the much greater imperative is to generate electricity and get this basic power source to the rural population throughout the continent.

According to Euro Esco's Andrea Vacca, Africa is the largest and most populous continent after Asia with 900-million people living in 53 different countries. African countries have excellent environmental conditions for the production of large photovoltaic plants and solar thermal plants and these would potentially play a significant role in reducing carbon dioxide emissions.

These views are borne out by African Renewable Energies, and company head, Dr Ian Humphery-Smith, says that while South Africa has a stable electricity supply it is one of just a handful of African

countries in that position.

The National Electricity Regulatory Authority of Nigeria estimates that Nigerians are currently spending 796,4-billion Naira a year on fuelling generators as an alternative electricity supply because the country's own electricity production is sporadic.

This figure is equivalent to the total sum spent by the Federal Government of Nigeria on capital projects in 2009. Nigeria is Africa's second largest economy after South Africa.

Humphery-Smith says that a bigger problem – and possibly a huge source of renewable energy – is represented by the fact that African cities are growing at an alarming rate and waste management processes cannot keep pace with the speed of urban expansion or the cost of infrastructure provision.

Landfill site across Africa are predominantly none-engineered rubbish tips that habitually leach toxic chemicals and carcinogenics into local surface and subterranean waters and these toxins make their way into the human food chain.

He says that increased urbanisation since the 1960s has given rise to major health hazards and a cancer time bomb for the inhabitants of most African cities. Moreover, refuse accumulation has contributed directly to the increased disease transmission with outbreaks of Yellow Fever becoming widespread throughout Africa.

Yellow Fever is spread by the *Aedes aegypti* mosquito and more than 80 percent of mosquito bites in downtown Abidjan in Cote d'Ivoire are attributed to this insect. It is this species that specifically breeds in refuse and peri-domestic settings.

Examples of the high-risk countries for Yellow Fever in Africa are directly correlated to its urbanisation.

Country	Population (Millions)	Percentage of Urban Dwellers
Burkina Faso	13,2	19
Ghana	22,1	46
Liberia	3,3	48
Cote d'Ivoire	18,2	46
Senegal	11,7	51
Guinea	9,4	37
Benin	8,4	46
Nigeria	131,5	48
Cameroon	16,3	53
Sierra Leone	5,5	40
Gabon	1,4	85
Togo	6,1	36

He says that the urban population of children in these high-risk areas

is about 100-million.

To put the landfill dump sites into perspective Humphery-Smith says that in Akouedo, Abidjan, in Cote d'Ivoire, since 1968, 101 hectares of land has been transformed into a single landfill site with rubbish up to 35 metres deep and soak up to 30 hectolitres of rainfall a year.

For more than 40 years toxins have been leaching into the groundwater and the rivers and streams from that landfill site alone, transforming some of the water into a toxic treacle.

He also refers to the Dandora landfill site in Nairobi that is 12 hectares in extent and is disseminating toxic leachate away from the dumpsite into culverts and creeks and into the natural water systems. Moreover, near the Vingunguti dumpsite in Dar es Salaam, Tanzania, contamination from the dumpsite means that people are no longer drinking any water from the dug wells because it is so contaminated.

As many of the heavy metal toxins make their way into the lakes and river systems throughout Africa, the fish stocks are increasingly transmitting heavy metal carcinogens to the local population who rely on fish as their staple diet.

This is exacerbated by the extensive and indiscriminate dumping of waste in urban areas in all the urbanised regions.

Humphery-Smith says that the landfill sites offer huge opportunities to generate cheap and renewable energy but he says that the problem requires an integrated approach to past and future waste management that includes:

- Effective waste collection, recycling and composting;
- Solid and liquid waste treatment and disposal;
- New engineered landfill sites for future refuse.

His solution to the problem is to retrofit what he calls "umbrellas" to the existing landfill sites using an impermeable geo-membrane designed to prevent rain from entering the landfill and stop toxic leachate from escaping from it.

The geo-membrane could use a thin-film solar member for further power generation while the methane gas could be recovered and used for electricity generation.

The cover would prevent rats, flies and mosquitoes from breeding in the refuse, reducing the risks of Yellow Fever epidemics. In simple terms, he wants to cape existing landfill sites with geo-membranes that feature integrated solar-power generating capacity combined with simultaneous recovery of methane gas.

He says the advantages of this solution are:

- Lower operational costs (after the cost of the installation has been recovered);
- A single landfill site will provide an estimated 70 MW combined gas-to-energy and solar installation, saving about \$1,5-billion over 30 years in running and maintenance costs when compared with a pulverised-coal system of a similar size;

- It can be connected to a national grid with the sun providing a virtually unlimited source of energy that is clean and creates no carbon emissions of noise.

Humphery-Smith points out that this technology has been successfully used in various parts of the United States.

Apart from the use of solar energy and methane from landfill dump sites in Africa, Westinghouse says that more and more African countries are now considering using nuclear power to provide energy and as a result, Westinghouse has signed a Memorandum of Understanding with DCD Dorbyl for the localisation of nuclear building programmes in South Africa specifically and for other African countries as well.

It has developed a supplier directory of South African companies, signed non-disclosure agreements with suppliers and has agreed to localise manufacturing of nuclear fuel with the Nuclear Energy Corporation of South Africa (Necsa).

According to Van Zyl de Villiers, general manager of research and development at Necsa, coal-fired power stations are currently releasing about 25 000 tons of uranium into the atmosphere every year and yet if the nuclear energy sector did this it would be closed down immediately.

He says that nuclear energy is the only technologically mature, economically viable, non-green-house-gas emitting electricity generation technology that fits into the longer-term provision of Africa's base-load electricity supply on a large scale.

He says South Africa's nuclear energy policy objectives include the fact that this solution provides an important electricity supply option and secures energy security for the country while contributing to social and economic growth.

Necsa is currently the anchor for nuclear energy research, development and innovation while Eskom is the main operator of the nuclear power plants. The country has a National Nuclear Regulator and a National Radioactive Waste Disposal Institute and it has the architectural and engineering capacity to design, manufacture and construct nuclear energy systems.

The Minister of Energy, Dipuo Peters, has repeatedly said that South Africa is committed to the use of nuclear energy as part of the base-load electricity generation in the future and that a 20 000 MW nuclear power will be generated in this country by 2020.

The importance of the new build programme was emphasised by Eskom's managing director of system operations and planning, Kannan Lakmeeharan that demand is expected to return to the 2007 levels this year but if energy efficiency measures are not put in place by winter 2010, the power system will be tight.

When the utility has to return to its maintenance schedules then the risk of load shedding in post-winter 2010 and 2011 will increase. He says that Eskom is minimising the maintenance of its fleet during the



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- Observing how buildings can operate at optimum efficiency while minimizing energy waste
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- Tracking unused energy in building for greater energy savings
- Gaining insights on the latest energy efficient building technologies
- Ensuring Return on Investment on energy efficient features

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FIFA World Cup 2010 period and is also working with municipalities, stadium operators and other stakeholders to support the precinct requirements of the stadiums for the duration of the event.

However, Lakmeeharan has some serious warnings and predictions including:

- The adequacy of supply in 2012/13 is a serious concern;
- Demand-side management and energy efficiency are crucial over the next three years to ensure system adequacy;
- A worse-than-planned generation performance (from 86 percent to 84 percent) will result in higher risks and reduce system adequacy between 2011 and 2013.

According to the World Energy Council, about 590-million people (about 60 percent of Africa's population) do not have access to electricity and in sub-Saharan Africa cooking represents about 85 percent of the energy usage among low income rural households who rely on wood, charcoal, crop and animal residues for cooking fuels.

Lighting is provided from light emitting diode lanterns, batteries, paraffin and candles. The council says that North Africa, the Latin American countries, the Middle East, China and east Asia are aiming to provide their populations with universal access to electricity by 2030.

The council claims that South Asia is making substantial progress while sub-Saharan Africa is struggling to meet any of its goals having only achieved 46 percent of its electricity access rate.

When you visit countries like Nigeria, where electricity supplies are at best intermittent and the population relies on diesel generators for electricity, the scale of the problem facing Africa becomes enormous.

Only seven countries in Africa, namely South Africa, Libya, Namibia, Egypt, Botswana, Tunisia and Gabon have an electricity consumption per capita that is greater than 1 000 kWh per capita per year.

A further 11 countries have an electricity consumption of above 500 kWh per capita per year, those already mentioned along with Zimbabwe, Algeria, Zambia and Morocco.

Only two countries, South Africa and Libya, have achieved the world average of 2 752 kWh per person per year.

In order to achieve universal access to energy worldwide, an amount of \$35-billion will have to be spent every year from 2008 to 2030 and nearly 83 percent of this investment (\$29-billion a year) is needed in sub-Saharan Africa and South Asia.

In sub-Saharan Africa alone the estimate is about 50 percent of this or \$14-billion a year between now and 2038.

The World Energy Council says that for Africa to meet these sorts of targets it will have to have a mix of proper and adapted technologies that are tailored to meet the real needs of consumers. The mix of energy solutions will have to include:

- Grid-based facilities and distributed generation for power projects including photo voltaic, wind generators, micro-hydro, micro-

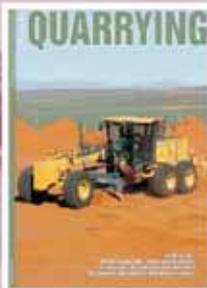
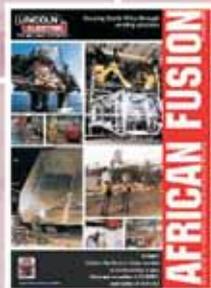
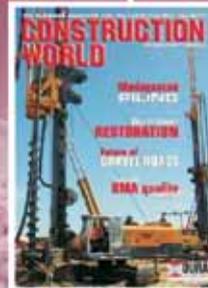
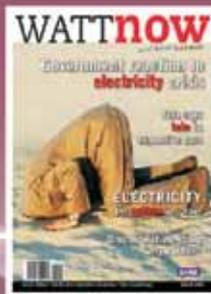
turbines using diesel fuel oil, natural gas or biofuels;

- An integrated infrastructure with multi-function platforms for water pumping, grain grinding, power generation and so forth;
- LED portable lanterns for domestic lighting;
- Liquid petroleum gas, paraffin and solar cookers and more efficient biomass cookers for cooking.

The council says that the key strategic directions include:

- Harnessing the huge energy resources that Africa has including its fossil fuels, renewable energy resources and atomic energy;
- Developing clean energy systems and energy infrastructure locally and regionally;
- Securing a diversified energy mix, specifically focused on renewable energy and clear fossil fuel systems;
- Establishing energy policies backed by stable and transparent regulations that are implemented by efficient institutions;
- Securing sustainable and innovative funding mechanisms that include private public partnerships;
- Expanding sub-regional, regional and international co-operation and integration of the energy resources and grids;
- Supporting human and institutional development and technical expertise through training, education, technical skills and technology transfer programmes.





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## Inkjet technology used to heal burn wounds

**I**nkjet technology is being used in a device that sprays skin cells directly onto burns to protect and heal their wounds. The device has been tested on mice and it is fitted in a frame that is wheeled over the patient in a hospital bed.

A laser is used to scan the wound's size and shape so that a layer of healing skin cells can be precisely applied to the area. Researchers at the Wake Forest University in Winston-Salem, North Carolina, developed the new technology.

Student Kyle Binder, who helped design the device says that the skin cells are "literally printed onto the wound". Test on mice showed that the spray system, called bio-printing, could heal wounds quickly and safely. The paper written by the students has been reported at the Translational Regenerative Medicine Forum.

According to Binder, wounds inflicted on the mice and then sprayed with skin cells healed in just two weeks while those that were not treated took five weeks to heal.

The team is now seeking approval from the United States Food and Drug Administration to test the device on human beings. The research is being conducted under the guidance of Professor George Christ, a professor of regenerative medicine at the school.

The students are also working with the United States Armed Forces Institute of Regenerative Medicine to develop ways to assist soldiers who have been wounded in Iraq or Afghanistan.

Binder and his colleagues dissolve human skin cells from pieces of skin, separating and purifying various cell types such as fibroblasts and keratinocytes. They put them in a nutritious solution to make them multiply and then use a system similar to a multi-colour office inkjet printer to apply a layer of fibroblasts and then a layer of keratinocytes, which form a protective outer layer of skin.

Victims of massive burns usually die from infection within two weeks of receiving the injury unless they receive skin grafts, and normal grafting usually leaves severe scars.

## Shareholders in angry fee wrangle over capital restructuring

**V**odacom is embroiled in a bitter battle with its partner in the Democratic Republic of Congo (DRC), Congolese Wireless Networks, over a number of issues including capital restructuring to support the continued growth of the business in that country.

Vodacom has decided to initiate arbitration proceedings after no agreement could be reached at the Vodacom shareholders' meeting early in April.

The arbitration will be lodged according to the International Chamber of Commerce's rules in Brussels.

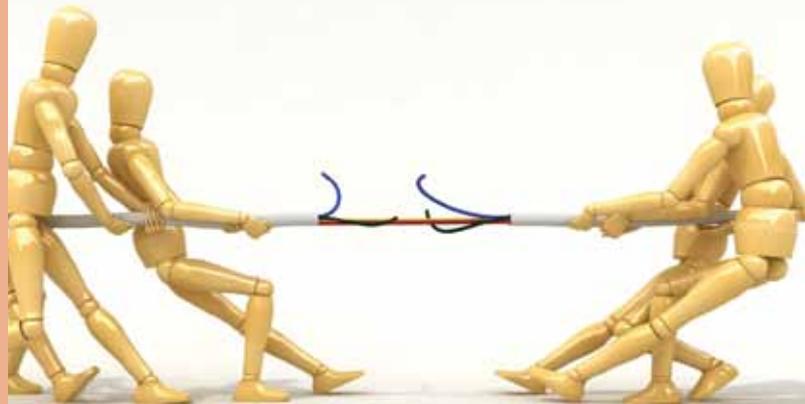
Congolese Wireless Networks threatened Vodacom with court action to get it to invest more money in the business. CWN owns 49 percent of Vodacom Congo.

Vodacom and CWN have had a long-running dispute over fees, including those to guarantee loans, which have apparently brought the partnership to the edge of bankruptcy.

Vodacom has apparently provided all the funding for Vodacom Congo at commercial rates that were agreed to by CWN. This funding was used to build infrastructure that connects more than 3,5-million Congolese. It has created 6 000 direct and indirect jobs in the process.

Vodacom chief executive, Bob Collymore, says the company believes that the region has the potential for excellent growth and to exploit new opportunities but points out that while it is ready to fund further expansion, the difficulties with CWN must first be resolved.

Africa is one of the few rapidly expanding mobile phone markets in and because the fixed line deploy is poor, mobile phones are the only communication tool for much of the population.





## Telecommunications undergoing extensive change

The telecommunications industry, both locally and internationally, has experienced tremendous changes in the past ten years and figures compiled by IBM in a special report entitled *Telco 2015* – in 1999 only 15 percent of the world's population had access to a telephone.

By 2009 this had changed dramatically with more than 70 percent of people having access to mobile phones. The decade also brought about steep declines in the public switched telephone networks, voice revenues and an explosion of what it calls over-the-top communications services.

However, IBM points out that despite the massive increase in revenue from mobile services, communications' revenue growth is now starting to falter as voice markets in developed countries are becoming saturated.

Unfortunately content and connectivity revenues have not risen quickly enough to offset these declines.

Developed countries have propped up the drop in fixed line service through the mobile communications technologies but as these markets become saturated, revenue growth as a whole is starting to decline. So where, the report asks, will future growth come from?

IBM suggests that there are several trends emerging and each of these has a high probability of achieving specific results. However, the report has also identified 12 key unknown trends that will have a major impact on the telecommunications industry as a whole.

These variables, it says, fall into two main categories: potential areas for growth and the prevailing competitive structures of the industry. The report refers to the following key factors:

- **Survivor consolidation:** Reduced consumer spending leads to revenue stagnation or decline. Developed market operators have not significantly changed their voice communications or closed connectivity service portfolio and have failed to expand horizontally into new vertical markets.
- **Market shakeout:** Investors are forcing carriers to disaggregate assets into separate businesses after a prolonged economic downturn. These assets have different return profiles, and retail brands emerge to aggregate and package services from these disaggregated units. Moreover, the report says, the market is further fragmented by government, municipality and alternative

provider initiatives that extend ultra-fast broadband to new areas. Operators are apparently looking for growth through horizontal expansion and premium connectivity services sold on application, and content providers as well as businesses and consumers.

- **Clash of Giants:** Carriers are consolidating, co-operating and creating alliances to compete with over-the-top providers and device or network manufacturers who extend their communication footprints. Mega carriers expand markets through selective verticals such as smart-grids and e-health initiatives for which they provide end-to-end connectivity solutions. By these means the telecommunications companies are developing a portfolio of premium network services and better-integrated digital content capabilities to deliver new experiences for businesses and consumers, claims the report.
- **Generative bazaar:** The barriers between over-the-top and network providers blur as regulation, technology and competition drive open access. Infrastructure providers integrate horizontally to form a limited number of network co-operatives that provide pervasive, affordable and unrestricted open connectivity to any person, device or object including a rapidly expanding class of innovative asset-light service providers.

The report says that only time will reveal which of these scenarios most accurately depicts what will eventually transpire. To be ready, providers need to watch for the key scenario triggers, understand the requirements for success in each of the contrasting environments, begin to close execution gaps and nurture critical capabilities that are common across the different scenarios. These include:

- Cost effective ultra-fast broadband deployment strategies;
- Business optimisation based on more advanced network and customer insights;
- More effective cost management;
- Highly collaborative culture, processes and systems;
- An agile business design.

IBM says that it is able to assist with business transformation and optimisation, customer experience management and service enablement, all of which are key to keeping telecommunications companies agile in a fast changing telecommunications world.

The full report is available from IBM. E-mail [iibv@us.ibm.com](mailto:iibv@us.ibm.com)

## Teaching people to fly in Afghanistan

Members of the United States Air Force are trying to mentor Afghan pilots and teach them how to fly rickety Soviet-era helicopters that make up the remains of the fleet.

To make matters even more complicated, there are either no instruction manuals, or the few that do exist are written in Russian. There are also no maintenance manuals for any of the craft.

Afghanistan once had a sizeable fleet of helicopters, cargo planes, bombers and jet fighters and at the height of the Soviet occupation of Afghanistan, the country's air force had 200 helicopters, 100 fighter jets and 7 000 personnel.

Today it has been reduced to just 46 helicopters (some of which are not working), a handful of jets and employs just 3 000 people.

But the Afghan Air Force has ambitious plans for expansion, including more than tripling the size of its fleet to 150 aircraft and boosting its staff complement to 8 000 by 2016.

In Kandahar about \$100-million is being spent on building barracks, ramps and facilities for the 250-strong air wing that is being trained by US Colonel Bernard Mater.

He says that many of the existing members of the Afghan Air Force are skilled pilots and quick learners.

But there are fundamental structural concerns. For instance, all air traffic control instructions are given in English at the busy Nato-controlled Kandahar air strip but the pilots do not understand English.

So a US pilot must accompany any Afghan pilot when he takes off. Mater says that he ordered 17 additional vehicles for the Afghan airmen only to discover that none of the pilots actually had a licence to drive a car.

Inside the helicopters that are still working, all words on the instrument panels and elsewhere in the craft are painted in Russian, and Cyrillic lettering is printed above the controls.

Mater says that the helicopters fly and handle more like tractors than agile aircraft. However, he says that they are sturdy, rudimentary craft without any sophisticated electronics and have an excellent safety record even though the paint is peeling off inside and the seats are frayed.

## IBM offers a hand to software developers

IBM has set up a new initiative to help start-up companies get free access to software and technology. The IBM Global Entrepreneur programme was launched in April and is aimed at entrepreneurs in developing regions of Africa, India and China.

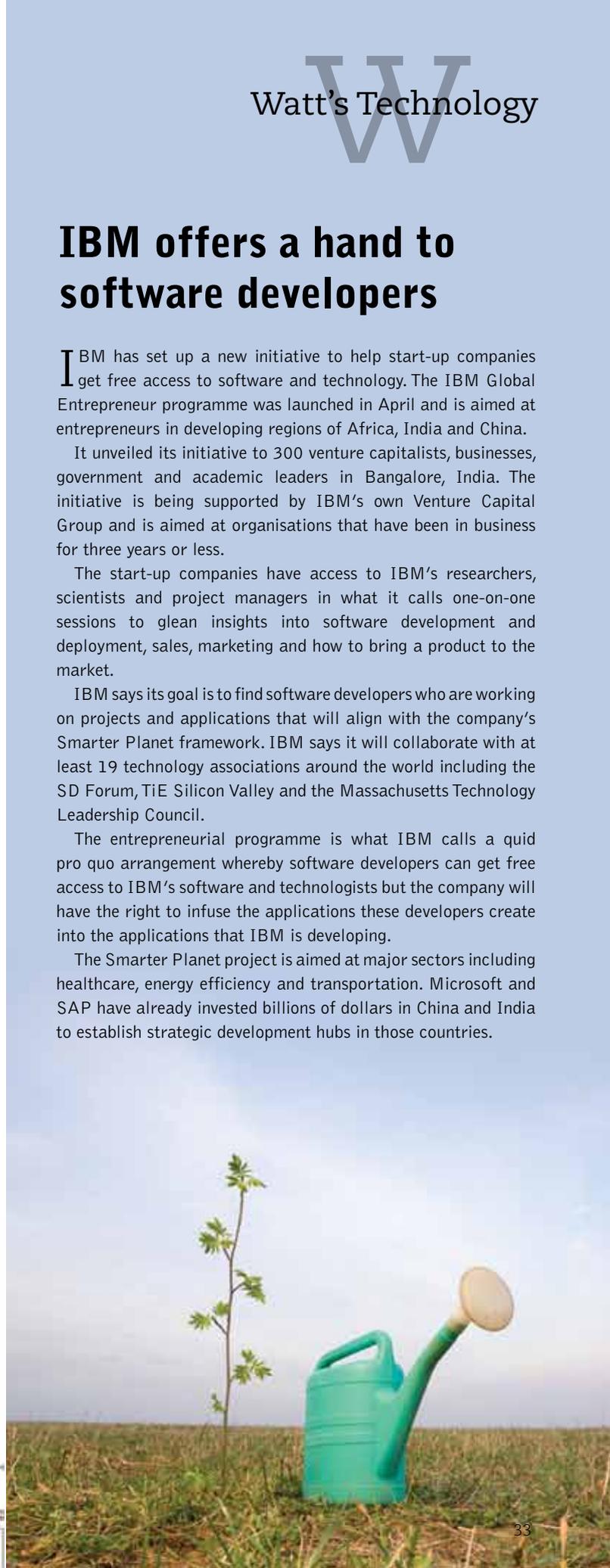
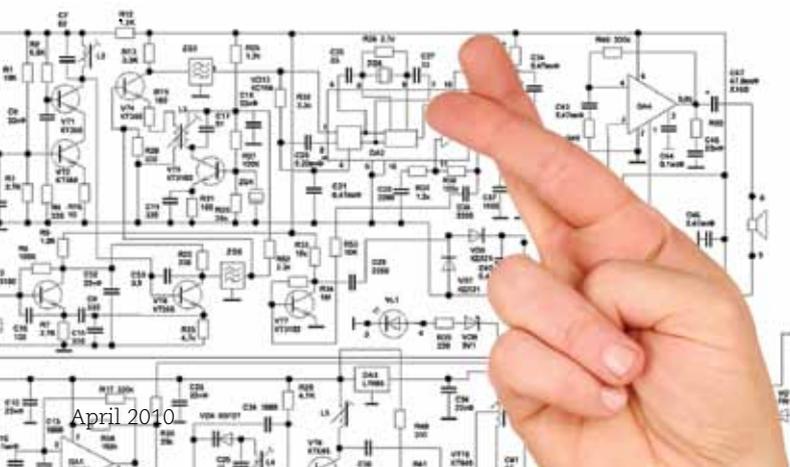
It unveiled its initiative to 300 venture capitalists, businesses, government and academic leaders in Bangalore, India. The initiative is being supported by IBM's own Venture Capital Group and is aimed at organisations that have been in business for three years or less.

The start-up companies have access to IBM's researchers, scientists and project managers in what it calls one-on-one sessions to glean insights into software development and deployment, sales, marketing and how to bring a product to the market.

IBM says its goal is to find software developers who are working on projects and applications that will align with the company's Smarter Planet framework. IBM says it will collaborate with at least 19 technology associations around the world including the SD Forum, TiE Silicon Valley and the Massachusetts Technology Leadership Council.

The entrepreneurial programme is what IBM calls a quid pro quo arrangement whereby software developers can get free access to IBM's software and technologists but the company will have the right to infuse the applications these developers create into the applications that IBM is developing.

The Smarter Planet project is aimed at major sectors including healthcare, energy efficiency and transportation. Microsoft and SAP have already invested billions of dollars in China and India to establish strategic development hubs in those countries.





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***The South African National Energy Association (SANEA) has as its vision "Energy People Working Together".***

SANEA strives to promote the sustainable supply and use of energy for the greatest benefit of all and to be acknowledged as a credible centre of knowledge, expertise and opinion on energy matters.

SANEA is a non-partisan, diverse energy association with international networks through the World Energy Council (WEC). WEC has member committees in over 90 countries. SANEA is playing a pivotal part in the future of energy in South Africa, bringing influential role-players together with a view of identifying and implementing sustainable and effective solutions, providing factual and relevant data and knowledge, strengthening the energy network in South Africa and globally, and enhancing awareness of energy issues in South Africa.

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**Email:** [brian.statham@eskom.co.za](mailto:brian.statham@eskom.co.za)

**Marketing Manager: Sarita Cronjé**  
**Mobile:** +27 (0)83 325 6716  
**Email:** [saritac@mweb.co.za](mailto:saritac@mweb.co.za)

**SANEA Website:** [www.sanea.org.za](http://www.sanea.org.za)



# Linux for netbooks from Jolicloud

While Linux has been regarded as a resounding failure when used on netbook computers, a new French company has modified a version of Ubuntu that it says provides a new netbook-oriented solution that works well. A test version of the operating system has been released.

The French company, Jolicloud, says that its software is the first working netbook operating system specifically designed to work on these devices. Netbooks currently account for about 15 percent of total portable computer sales worldwide.

When the netbooks were released a few years ago, Linux was the initial operating system of choice but because so many users found it confusing and unfamiliar to work with, it was supplanted by Windows XP by the original equipment manufacturers.

Windows XP still accounts for more than 90 percent of the netbook operating systems in use today but it is gradually being replaced by Windows 7 as more manufacturers switch to the newer operating system.

Jolicloud says that the Linux operating system is based on Ubuntu but does not try to replicate Windows in any way. According to company founder Tariq Krim, the operating system is a hybrid that offers users a number of distinct advantages over other systems such as Windows.

He says, for instance, if a user logs onto the Jolicloud web site all data and applications on the device are backed up into a special directory that is protected for the user with high levels of security and encryption. The server also synchronises any new device using the Jolicloud operating system with the applications and data from the first machine.

Krim has managed to raise \$4.2-million for his venture from a number of European venture capital firms. He is the founder of Netvibes.com, a portal site that allows the user to customise its web site interface with information widgets similar to those on iGoogle and Yahoo.



## Bloodhound project used as a teaching aid

A Royal Air Force fighter pilot, Andy Green, is coming to South Africa where he hopes to drive a rocket-powered vehicle at speeds of more than 1 600 kilometres an hour, creating a new land speed record in the process.

Several major companies including Lockheed Martin and Intel are sponsoring the pencil-shaped Bloodhound Super Sonic Car (SSC), but a key component of the project is to get schools more involved in science and mathematics.

According to Kate Bellingham, education ambassador for Bloodhound, there are already about 3 000 youngsters who have joined the Bloodhound Education Programme and she says that schools from all over the world can register for free and take part in the project.

Bellingham is a secondary mathematics teacher, an engineer and presents a television show, but her most important goal, she says, is to promote science, technology, engineering and mathematics at all levels including primary and secondary schools and at universities too.

There are already a number of projects available for free download from the Bloodhound SSC website and cover various different levels of education from a primary level to a diploma in engineering.

The Bloodhound will be powered by a jet and hybrid rocket motor. The rocket is to provide raw power without having a draggy air intake, but the problem with a rocket is that it is either on or off and cannot be controlled to run through a range of speeds. That's where the jet engine comes into the design.

According to Bloodhound's Richard Noble, by using the Eurojet EJ200 engine, which is both light and small, the driver is able to control the output of the Falcon rocket and the jet engine and in this way reach a target top speed of 1 610 km/h.

He says the most difficult part of the project is to control stability of the vehicle at high speeds and the rear wheel covers are vital in keeping the car on the road. The fins on the wheel arches are small so that the car won't be affected by crosswinds but will be stable enough on the salt surface to reach the speeds they are expecting to achieve.

The design elements used for this vehicle are available on the Bloodhound Education Programme's website at [www.bloodhoundssc.com](http://www.bloodhoundssc.com).



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Dear Paddy,

I have embarked on a renewable energy project to give electricity to the over 3000 rural and farm schools in South Africa, which are currently operating without electricity, off the National Electricity Grid, by using Wind Turbines.

My company is called Network Surplus Trading, trading as Surplus South Africa ([www.surplussouthafrica.co.za](http://www.surplussouthafrica.co.za)), I have always kept a keen eye out for a solution to electrify schools and clinics in South Africa and I finally secured a locally produced wind turbine made by Kestrel ([www.kestrelwind.co.za](http://www.kestrelwind.co.za)), which is owned by Eveready (the battery company).

South Africa currently has 26 566 schools, nationwide, but there are 3120 schools across the country which do not have electricity.

My pilot school was sponsored by the owners of Kestrel and their distributor S & P Power who gave their products and services free of charge. S&P Power specialise in designing, supplying and installing alternative energy systems.

This includes solar systems, wind turbines and back-up power systems. S & P Power will be responsible for the actual installation of these wind turbines under the directorship of Chris Osborne (Telephone: 012-335-5734).

The first school in the Eastern Cape, which received a wind turbine was Extensions Primary School.

S & P Power has now completed the installation at the school and it is now fully electrified and will act as my pilot project. I have an official list of schools, which do not have electricity, but I encourage principals at schools without electricity to contact me.

I have also secured partnerships with Microsoft who will supply educational software to all the schools I electrify and computers from Intel, which will also be given to schools once I have electrified them.

This, including the turbines, will be at no cost to the school or the Department of Education, as my whole business plan is designed so that corporate sponsors will cover all the costs in the form of an Adopt-a-School Programme. I am still looking for a sponsor for printers and photocopiers.

If companies need to know more about my project they can visit my website [www.surplussouthafrica.co.za](http://www.surplussouthafrica.co.za) or email me at [ben@surplussouthafrica.co.za](mailto:ben@surplussouthafrica.co.za).

Kind regards,  
Ben Sassman

## What if Dr Seuss wrote technical manuals

Ian McKechnie, past president of the South African Institute of Electrical Engineers recently sent me this little gem that was apparently written by a chap called Gene Ziegler in 1995.

What if Dr Seuss wrote technical manuals

Here's an easy game to play.

Here's an easy thing to say:

If a packet hits a pocket on a socket on a port,  
And the bus is interrupted as a very last resort,  
And the address of the memory makes your floppy disk abort,  
Then the socket packet pocket has an error to report!

If your cursor finds a menu item followed by a dash,  
And the double-clicking icon puts your window in the trash,  
And your data is corrupted 'cause the index doesn't hash,  
Then your situation's hopeless, and your system's gonna crash!

You can't say this?

What a shame sir!

We'll find you

Another game sir.

If the label on the cable on the table at your house,

Says the network is connected to the button on your mouse,

But your packets want to tunnel on another protocol,

That's repeatedly rejected by the printer down the hall,

And your screen is all distorted by the side effects of gauss

So your icons in the window are as wavy as a souse,

Then you may as well reboot and go out with a bang,

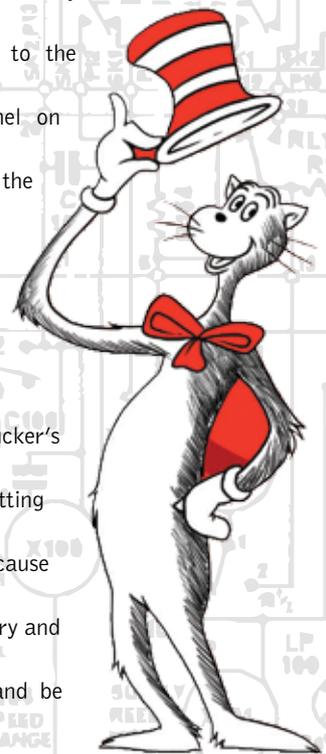
'Cause as sure as I'm a poet, the sucker's gonna hang!

When the copy of your floppy's getting sloppy on the disk,

And the microcode instructions cause unnecessary risc,

Then you have to flash your memory and you'll want to RAM your ROM.

Quickly turn off the computer and be sure to tell your mom!



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## Clever women drink more than dumb women



A rather astounding study done by researchers at the London School of Economics claims that professional women who have a degree in any particular discipline are more likely to be heavy drinkers than those who have not studied.

The report written by Maria Hueerta and Francesca Borgonovi claims that the cleverest women are at a much greater risk of becoming alcoholics than those women with little or no education.

A similar link between educational attainment and alcohol consumption has apparently been found among men but is less strong.

They claim that this is because better educated women

tend to have children later in life and lead a more active social life and this might contribute to the fact that they consume more alcohol. Moreover, they also hold down jobs in a workplace that is dominated by men where drinking is more acceptable.

According to the report, a woman with a degree is 86 percent more likely to drink every day than women who had no qualifications. The research was based on data from thousands of people born in Britain in one week in 1970.

The researchers looked at the school test scores given to pupils aged five and ten and found that both men and women who scored highly were significantly more likely to abuse alcohol than people who scored poorly.

In 2007 another study of women found that girls with a university education were more likely to binge drink than women who had little or no education.

## Laughing gas in the Arctic is no laughing matter

The thawing permafrost in the Arctic may be releasing large volumes of nitrous oxide or laughing gas into the atmosphere

according to a report conducted by a team of Danish and Norwegian scientists.

The team measured emissions from the thawing wetlands in the Zackenberg in eastern Greenland and found that the gas there was 20 times the level found in tropical forests, which are the main natural source of the heat-trapping gas.

According to the scientists, the measurement of nitrous oxide production from five additional wetland sites in the high Arctic region indicate that the rates of nitrous oxide production in the Zackenberg soils may actually be in the low range.

The nitrous oxide emissions would add to the known impact of global warming and climate change. It is considered the third most important greenhouse gas after carbon dioxide and methane.

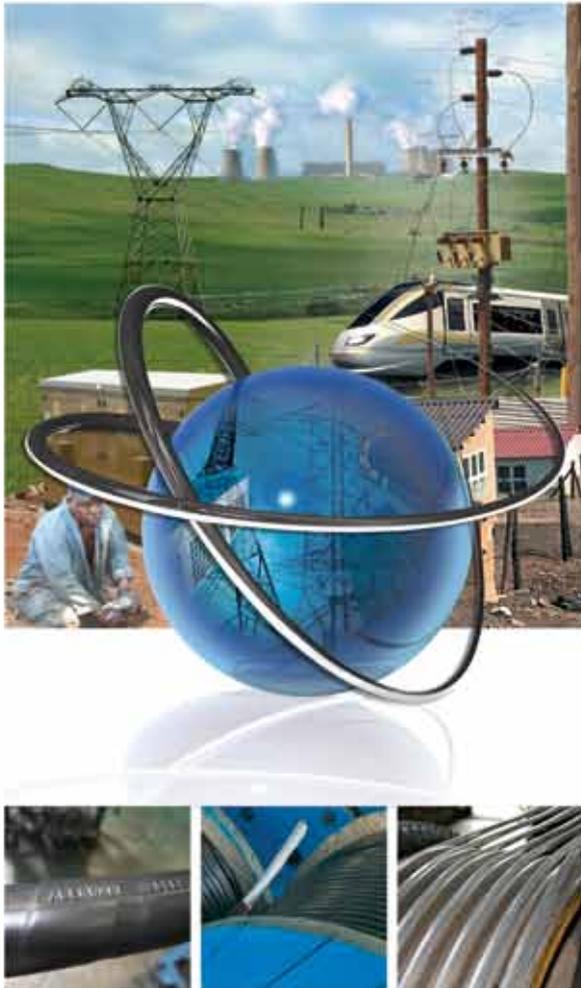
It is among the gases covered by the United Nations' Kyoto Protocol for limiting global warming. Nitrous oxide comes from a range of human activities including agriculture – mainly as a result of nitrogen-based fertilisers – and the use of fossil fuels.

The scientists say that other studies done on the thawing permafrost in the Arctic indicated that carbon dioxide and methane were released but that the nitrous oxide was contained in the permafrost rather than being ejected into the atmosphere.

According to lead researcher, Bo Elberling of Copenhagen University, re-saturation of the drained soils with melt-water from the frozen soils – as would happen following thawing – increased nitrous oxide production by twenty-fold.

He says that nearly 60 percent of the nitrous oxide produced in this way escaped directly into the atmosphere.





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## LHC now producing millions of mini-Big Bangs

Physicists at European Centre for Nuclear Research (CERN) have already created about 10-million mini-Big Bangs in the Large Hadron Collider that is situated deep below the ground on the Swiss-French border near Geneva.

According to LHC spokesman James Gillies, the machine is functioning extremely well and scientists are able to smash tiny particles together at speeds just below the speed of light and then analyse the results.

He says scientists keeping watch on the 27-km oval-shaped ring are recording collisions at the rate of about 300 a second at energy levels of seven tera (seven-million-million) electron volts (TeV).

The collisions create simulations, on a tiny scale, of what scientists believe happened after the Big Bang some 13,7-billion years ago.

By tracking how the particles behave after colliding, the researchers hope to unveil many secrets of the cosmos including the make-up of dark (or invisible) matter, why matter gained mass and if there are more than four dimensions already known.

By the middle of this decade scientists are hoping to double the collision impact energy to 14 TeV. Scientists have postulated propositions such as additional dimensions for years and a key factor in this line of thinking is based on string theory, which suggests the basic ingredients of the cosmos are tiny strings of matter.

The LHC has cost \$9,4-billion to build and thousands of scientists from 30 countries are involved in the research and in analysing the data that is collected after each collision.

Scientists at CERN have unequivocally rejected the notion that they are able to create mini black holes that could suck surrounding matter into them and bring an end to the Earth and all its inhabitants.





## In control – in an optimal way!

By David H Jacobson, Past President of the SAIEE

Every engineer's objective is to design the best product or system and to get the highest operating performance out of them, subject of course to practical cost and engineering constraints. Indeed, the contemporary design of electrical and electronic and other engineering devices and the operation of many complex processes can be enhanced significantly using mathematical and computational techniques of optimisation and optimal control.

Systems, such as power-generating and distribution networks, broadband communication systems, aircraft, chemical processes, economic systems, have at the disposal of their designers and operators certain controls which can be modulated so as to enhance some desired property of the system.

For example, in commercial aviation, best fuel usage at cruise is an important consideration in profitability of the airlines in these times of harsh business conditions. In economic systems, full employment or the growth of the gross domestic product are measures of economic system performance.

These may be enhanced by proper choice of controls such as interest rates determined by the Reserve Bank or altered tax codes devised by the Ministry of Finance.

The essential features of the above-mentioned systems are the dynamic model of a system, the available controls, the measure of system performance, and the constraints under which the system must operate.

Models of complex dynamic system often are described by a set of first-order coupled nonlinear differential equations representing the propagation of the state variables as a function of the independent variable, usually time.

The vector which describes the state of a physical system at a particular time, the 'state vector', may be composed of position, velocity and acceleration. In the case of an electrical system, the control vector which affects the way in which the solution of the

nonlinear differential equation model evolves in time may, for example, be a generator setting or a load-balancing profile.

The performance criterion which establishes the effectiveness of the control process on the dynamical system can take many forms. For a power-electrical system, desired performance may be a measure of system efficiency such as primary fuel consumed in generating electricity to meet a specific power demand.

The engineering problem to be solved is to optimise the value of the performance criterion subject to the constraints imposed by the system dynamics and other constraints of an engineering nature. Important classes of constraints are those imposed at the termination of an operating shift and path constraints throughout the time of operation of the system.

When controlling an aircraft, maximum fuel constraints or maximum altitude constraints may have to be satisfied.

While optimality conditions which a control strategy must satisfy if it is to be an optimal one are relatively easy to apply, their derivation, in the case of the most general nonlinear models, is highly detailed and abstract and not accessible to most engineers. This is the domain of the mathematician rather than the engineer.

This is unfortunate because it is both highly desirable, and satisfying, for engineers to understand the derivations and underlying assumptions of the optimising techniques which they use. This is in fact essential if they are to apply the right optimisation tools for the particular problem at hand.

The new book *Primer on Optimal Control Theory* by Jason L. Speyer and David H. Jacobson published in April 2010 by the Society for Industrial and Applied Mathematics (SIAM) gets the reader to think about the subject of optimal control at the right level of abstraction for engineers.

The text is designed to be of value to prac-

tioners and advanced undergraduates and post-graduate students who are studying optimal control theory in electrical, mechanical and chemical engineering, as well as those students in computer science who learn control theory while studying robotics.

The objective of the book is to make optimal control theory accessible to a large class of engineers and scientists who are not mathematicians, although they do have a basic mathematical background, and who need to understand and want to appreciate the sophisticated material associated with optimal control theory.

Therefore, the material in this new book is presented using elementary mathematics, which is sufficient to treat and understand in a rigorous way the issues underlying the limited class of control problems treated in this text.

Although more advanced topics that build on this foundation are covered only briefly, such as inequality constraints, singular control problems and advanced numerical methods, the foundation laid in this accessible text should be adequate to enable the reader to move on to the rich literature on these subjects if he/she has a higher mathematical interest.

The book begins with an example to illustrate simply some of the concepts found in later chapters. These, as well as more advanced topics of optimisation in the following chapters are handled using mathematics at a level consistent with that taught in undergraduate and post-graduate engineering courses.

Therefore, the treatment in this book is not the most general, but it does cover in an accurate way a large class of optimization problems of practical concern. Details about the book are available at: <http://www.ec-sechost.com/SIAM/DC20.html>

In the words of one anonymous reviewer of the pre-publication manuscript, "I wish I had had the essence of this book when I first studied optimal control theory," he said.

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# Eskom smiles as World Bank approves its R27,25-billion loan

Eskom's board probably breathed a sigh of relief after its loan of \$3,75-billion was approved by the World Bank despite widespread abstentions from various governments including the United States and The Netherlands.

The US is concerned about the effects the two new coal-fired power stations will have on climate change, saying that South Africa is not doing enough to implement renewable energy projects.

The Netherlands accused Eskom of doing too little to develop alternative sources of energy. However, World Bank loan applications are approved or declined on the basis of consensus rather than on voting.

Eskom has relied on this loan for the continued construction of the power stations and said last month that it "had no plan B" if the loan was not approved. There has also been widespread criticism of the loan from various groups in South Africa.

Leader of the Democratic Alliance, Helen Zille, pleaded with the World Bank to stipulate in the loan that the African National Congress would not directly benefit from the construction of the two new power stations.

The ANC, through its shareholding in Hitachi, apparently stands to gain at least R1-billion from the project. The ANC's investment business, Chancellor House bought shares in Hitachi some years ago.

She alleged that the presence of Vali Moosa – then chairman of Eskom – ensured that the tender was awarded to Hitachi. Moosa is a member of the National Executive Committee of the ANC.

The Public Protector investigated these allegations in February this year and declared that there had been a conflict of interests but that Moosa had not influenced the tender process.

In a separate development, residents of Limpopo province lodged a complaint with the World Bank – just after Eskom applied for its loan – saying that the construction of the new power stations would significantly damage the environment and the health of people living in the province.

Energy Minister Dipuo Peters reacted angrily to the objections, telling delegates at a meeting of Business Unity South Africa that all South Africans should support the loan because at least 25 percent of South Africans were still waiting for access to basic services that include electricity.

Eskom has warned that if it does not build new power stations then the economic growth of South Africa will be dramatically reduced and this will have a negative impact on development, job creation and the quality of life of all businesses and individuals.

The United States, The Netherlands, Earthlife Africa and GroundWork contend the loan violates a number of World Bank policies on clean energy and a reduction of greenhouse gases.

Earthlife Africa and GroundWork claim that there are already illegal mining operations taking place in the area for the building of the Medupi power station. There are plans for new coal mines to be established in the area as well.

The groups have also expressed concern about the lack of available water in the area.

Electricity consumption in South Africa rose by 8,5 percent year-on-year in February while electricity production increased by 9,1 percent according to figures released by Statistics South Africa in April.

Electricity purchased from outside South Africa increased by 0,3 percent to 2 117 GWh compared with the first two months of last year.



## Toyota Motor Corporation and Mazda agree on hybrid system technology licence



Toyota Motor Corporation and Mazda Motor Corporation have reached an agreement on the supply under licence of the hybrid technology used in the Toyota Prius.

Leveraging this agreement, Mazda plans to combine the hybrid system with its next-generation SKY\* engine that is currently under development, and develop and manufacture a hybrid vehicle in Japan. Mazda is aiming to sell its hybrid vehicle starting in Japan by 2013.

Positioning response to environmental issues as a management priority, TMC began sales of the Prius, the world's first mass-production hybrid vehicle, in 1997. Since then, over 2,3 million Toyota hybrid vehicles have been sold to customers in over 70 countries including South Africa.

Toyota recognises the importance of benefiting the

environment by encouraging the popularisation of its eco-friendly technologies, which are represented by its hybrid systems. Accordingly, Toyota will consider requests from other companies to use its hybrid technology.

Based on its long-term vision for technology development, Mazda aims to increase the average fuel economy of Mazda vehicles sold globally by 30 percent by 2015, compared with average fuel consumption in 2008 level.

In order to offer all of its customers driving pleasure as well as outstanding eco-friendly and safety performance, Mazda is implementing a strategy that will enhance the core aspects of its vehicles—including engines, transmissions and weight reduction—and then progressively add electric devices such as idling stop, regenerative braking and hybrid power.



## Durban residents and businesses stricken by constant power failures

The business community and individual residents in Durban have been forced to deal with sustained power failures during March amid allegations that the disruptions are actually being caused by Eskom load shedding.

Durban's city manager Michael Sutcliffe has denied that any load shedding has occurred or that it is being done secretly. However, he is unable to comment on why there were so many general faults or why there were widespread power disruptions.

He says that there is a large amount of road construction going on throughout the city and says that it's possible that water seeping into the ground is coming into contact with electricity cables and causing faults.

According to Sutcliffe, most faults are repaired within two hours but that it depends on the nature of the fault and how much work is needed to restore power.

Suburbs that have been affected by the power outages include Westmead, Assagay, Mayville, Waterfall, Glen Anil, Mahogany Ridge Industrial Park and Durban's central

business district.

Businesses situated along Florence Nzama (previously Prince Alfred) Street have been without electricity for several days, seriously disrupting all business in the area.

According to furious business owners, they've been forced to buy generators to try and keep their businesses running because of the severe supply interruptions.

With the extensive number of occupied flats in the central business districts, residents have become equally frustrated and 79-year-old Toby Dixon says that he has been forced to walk to his flat on the tenth floor for several days because the power has been out.

According to Lilian Develing, chairperson of the Combined Ratepayers' Association, Durban's electricity infrastructure has not been upgraded at all in the past 14 years and is now starting to fail.

The Durban Chamber of Commerce plans to hold urgent talks with the council to try and rectify the problem or at least get to the bottom of the cause of the power outages.

## Peters wants Mthombo project to go ahead at Coega

South Africa's Energy Minister Dipuo Peters is keen to see the Coega crude oil refinery go ahead in the Eastern Cape, saying that the refinery is essential for the country's continued supply of cleaner fuels.

The Mthombo project is the focus of a study by the country's national oil company PetroSA, which believes the 400 000 barrels-a-day refinery will help stabilise South Africa security of liquid fuel supplies.

BP Africa is opposed to the project and has called on the government to assess all the different supply options before going ahead with the \$11-billion project. The Mthombo project is not linked to a pipeline and unless a new pipeline is built its products will have to be carried by road, rail or shipped to Durban and sent to Gauteng via the existing Transet pipelines.

Peters claims that the project has a wide number of strategic benefits that include developing modern refining capacity. Major oil companies have apparently signalled their intention to withdraw from downstream activities in Africa by placing the future of South Africa's fuel quality firmly in the national refineries' hands.

PetroSA has already made representations to the government in a bid to persuade it to fund the engineering design of the new Mthombo refinery. PetroSA has indicated that it would prefer to be a minority shareholder in the project.

The organisation has been seeking an injection of R2,4-billion from government for the engineering design but has spent R250-million on the pre-feasibility studies.

There is a glut of refining capacity in South Africa at the moment and many of the independent refiners believe that the project is unnecessary particularly as the Coega site is so remote from the key markets inland.

An investment decision by the government is not expected before 2012.



## Rural biofuels project may benefit KZN residents

A major biofuels project is underway in the Ilembe district municipality in KwaZulu Natal and according to Vuthwa Biofuels' spokesperson, Kanyi Gasa the project is a result of a partnership between the company and GC Biofuels.

GC Biofuels is an engineering company that specialises in the production of sustainable and environmentally friendly liquid fuels and it will provide the technical expertise for the project.

According to Gasa, the communities in the Ilembe district will use fallow agricultural land to grow trees to provide the feedstock for the production of biofuels. The feedstock will be transported to Buthwa's localised processing facility that will produce biofuel and glycerine as a by-product.

Gasa claims that the project is different from other biofuels projects because:

- Its emphasis is on social upliftment and community involvement;
- The production processes are all localised;
- It will use the Moringa Oleifera tree as the primary feedstock source as it can survive in relatively unfavourable conditions, does not provide food and does not require any sophisticated farming methods.

- It is resistant to extended dry periods and will flourish in marginal areas. The seeds apparently yield a high volume of vegetable oil that is extremely stable.

According to Gasa the company has, through its pilot facility in Pinetown outside Durban, managed to simplify the production process to such an extent that it will be able to set up plants in low technology rural settings and can be staffed by people who have limited formal education.

The pilot plant has been operating for two years and supplies biofuels on a commercial basis to a petroleum wholesaler that has been running a fleet of vehicles on the product.



## Illegal connections kill eight Mayville Primary School children

For many years energy thefts have plagued Eskom and other municipalities but little has been said about the extreme danger that goes alongside the many thousands of illegal connections that are made to the local distribution grids.

So it is tragic when things go wrong as they did at a Durban school recently. Eight children from the Mayville Primary School were killed after coming into contact with exposed wires from illegal power connections. The latest victim was a 10-year-old boy.

The wires are connected to an electricity cable next to the wall that supplies a block of classrooms and then runs over the wall, through the trees and into a nearby group of homes.



According to one of the teachers at Mayville Primary, she has been held-up by bandits with guns demanding that she switch on the power so that the power can be supplied to the nearby shacks.

A lock on the school's main power supply has been smashed several times and several cables at the school have been tampered with so that electricity thieves can continue to extend their illegal network.

The teacher says that when there is a lot of rain the cable tends to overheat and even catches fire. The school is faced with paying the bills for repairs and for the electricity consumption but it has spoken to the council and shown the council the illegal connections.

However, the council has not rectified the problems and has also not been able to police or remove the illegal cables running into the shacks.

Bandits have also vandalised school property, broken the gate locks several times, stolen metal and copper objects, aluminium taps, door handles and even the sewage metal drain covers, copper pipes, metal sinks and metal from desks and chairs.

The metal is thought to be finding its way to various scrap metal dealers in the Durban area.

The eThekweni Municipality has promised that it will send security guards to the Mayville School in an attempt to bring a stop to electricity theft.

Power theft and illegal connections result in losses of at least R100-million a year to the municipality over the past five years according to Energy Minister Dipuo Peters.

In a written response to a question in Parliament in March, Peters said that illegal connections and non-technical losses had cost Eskom more than a billion rand in the 2008/2009 financial year.

## Fund for basic infrastructure aims to raise a billion dollars

The International Finance Corporation plans to invest at least \$100-million on the second Africa Infrastructure Investment Fund. The purpose of this fund is to develop the basic infrastructure of many different African countries.

The African Infrastructure Investment Managers established the Fund, which is a joint venture between Macquarie Africa and the Old Mutual Investment Group South Africa. It aims to raise between \$600-million and \$1-billion in unlisted and listed equity infrastructure investment in sub-Saharan Africa.

The fund is planning to take significant stages in a number of projects that include toll roads, wind farms, renewable energy projects, port improvement and upgrading work, along with improvement or new water and sewage utilities.

According to Andrew Johnstone, the managing director of the Africa Infrastructure Investment Fund the fund will facilitate the development and sustainable operation of many different basic infrastructure projects across the continent.

He says that infrastructure development is crucial for Africa to be able to accelerate economic and social development and sustainability.

The International Finance Corporation is a member of the World Bank and aims to help African countries develop assets that include a reliable power supply and road networks.

Africa's infrastructure has gradually deteriorated in most countries through a lack of maintenance, a shortage of funds and no investment in projects that are essential. Moreover, widespread corruption in previous years has made many investors particularly wary about investing in the continent because money earmarked for development seldom translates into a completed project.



## African countries keen to build nuclear power plants?

Not many people know that there are seven African countries that are running 11 nuclear reactors in Africa and that more and more African countries are considering building nuclear power plants to resolve the energy crisis that faces much of the continent.

The countries that have nuclear power plants are Algeria, Egypt, Ghana, Libya, Morocco, Nigeria and South Africa.

South Africa actually has three reactors: one research reactor at Pelindaba, near Hartbeespoort Dam; and two pressurised water reactors that power the Koeberg nuclear power plant near Cape Town. There is a strong likelihood that South Africa will build a second nuclear power plant at some time in the future.

The other countries with nuclear capacity do not have nuclear power plants but do have research reactors that are much smaller and simpler to operate, as they do not generate any electricity.

However, representatives from all seven countries attended the recent International Conference on Access to Civil Nuclear Energy in Paris along with representatives from Namibia, Senegal and Tunisia.

The International Atomic Energy Agency has been asked to undertake studies for a number of African countries that may lead

to the adoption of nuclear energy strategy to generate electricity for local consumption.

Over the past two years, Algeria, Libya and Tunisia have apparently signed agreements with the French government to establish a framework so that French companies will supply the expertise to build and operate nuclear power plants.

The French International Nuclear Agency is responsible for implementing the assistance programmes. Hassan Younes, Egypt's Electricity and Energy Minister told delegates at the conference that nuclear power plants were being very seriously considered by many African countries because civil nuclear power is a viable alternative to using fossil fuels for the production of electricity.

He says that Egypt should have had at least one nuclear power plant years ago but the programme to build a nuclear plant was stopped shortly after the Chernobyl disaster in the Ukraine.

He says that Egypt is working closely with the IAEA to establish a nuclear regulatory authority ahead of building a new nuclear plant.

Meanwhile, Namibia's Mines and Energy Minister Erkki Nghimtina says that Namibia will be building a nuclear power plant within the next 15 to 20 years and confirmed that the government will build a nuclear plant before 2030.

He says that this is part of a government strategy to transform Namibia into an industrialised country and because of this, Namibia needs a reliable and sustainable source of energy.

However, he emphasised that at this stage a target date for a new power plant had not been set. He said that it is ironic that while Namibia produces large quantities of uranium, it still battles with a shortage of electricity. The country generates about 400 MW of hydro-electric power but this drops by 35 percent during the dry season when the river flows drop.

He concedes that there is a significant shortfall between local generation and local demand and Namibia imports as much as 60 percent of its power from South Africa and from other countries in the Southern African Development Community.

According to Gerard Mestrallet, chief executive of French energy group GDF-Suez, a modern nuclear power plant will last for about a hundred years from the start of planning to the post-decommissioning and clean-up of the used plant.

He says that while nuclear plants are extremely capital intensive, because of the long life of a plant, funding can be recouped over a longer period.



# Mentorship

The SAIEE is offering mentorship and advice to young engineers.

The offer comes at a time when our country is suffering a shortage of skills, and we believe that mentoring is an essential requirement in the training and development of the next generation of engineers.

If, as a member of SAIEE, you believe that you need a mentor you can request a mentorship service from the Institute.

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

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

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

sonal situation, having been there him- or herself.

The mentee will be able to discuss problems and frustrations with his independent mentor, who would have no stake in the outcome, and who would be able to provide an unbiased opinion and advice. The mentee might not be able to do so with his superiors, particularly if he is unhappy, and is considering an alternative career.

The mentor and mentee could arrange to meet regularly, but not too often say a few times a year, when both should have enough time to listen properly to what the other has to say.

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

Among its more than 5000 members the SAIEE has many experienced engineers who are willing to act as mentors. They are spread across the country and include engineers who are experienced in steelworks, furnaces, rolling mills, mining, manufacturing, electrical generation transmission and distribution through to light industrial, process control, instrumentation, telecommunication, robotics, automation, software development and engineering management of these sectors.

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



## Prospective SAIEE Mentors

If you feel you that you have the time and interest to help mentees, please contact Ansie Smith on [smitha@saiee.org.za](mailto:smitha@saiee.org.za) or 011 487 9050,

In addition you gain CPD credits, for when you are required to re-register.

# Renewable energy might not be a panacea

Renewable energy is likely to spawn a number of large new organisations that will employ thousands of people and stabilise South Africa's energy situation according to Thembanani Bukula, regulation manager for electricity at the National Electricity Regulator of South Africa (Nersa).

He says that while Nersa has published its Renewable Energy Feed-in Tariffs (REFIT) for wind power (R1,25 per kWh) this is still considerably higher than Eskom's tariff to municipalities which, after the latest increases, will see Eskom supplying power at 65c per kWh.

He says solar power is even more expensive at a tariff of between R3,14 and R4,80 a kWh. Bukula blames the high installation costs for the steep price of solar and wind power and claims that, in time, there is a likelihood that the installation costs will drop.

He concedes that the running and maintenance costs of solar or wind plants are generally lower than any other form of power generation.

Bukula points to the fact that Sasol has announced plans to produce flexible solar panels using a new technology developed by Professor Vivian Alberts of the University of Johannesburg. Moreover, Bukula says, multi-national companies are expected to start producing wind turbine components locally once they are satisfied that the local industry has stabilised.

According to Mainstream, a company specialising in building wind farms, the R1,25/kWh tariff is acceptable and it has apparently applied for a licence to build a wind farm. If this is successful it will fund the construction of the wind farm itself.

Bukula points out that co-generation projects based on producing electricity from steam or heat exchangers could contribute significantly to stabilising South Africa's power supplies and says that organisations such as sugar mills or paper plants could sell their excess electricity based on steam to Eskom.

According to Nersa, Eskom will, in the longer term, provide only 70 percent of South Africa's total electricity requirement, with the balance coming from renewable energy companies or co-generation projects.

Eskom is currently the buying office for all electricity in the country and this is a controversial point because Eskom will only buy extra power when and if it suits the organisation. Many independent analysts have warned that this is not a sensible situation as the agreements to buy electricity for the national grid should not be controlled by the largest electricity supplier in the country.

One company, IPSA has apparently been on the verge of insolvency because it has yet to reach agreement on tariffs with Eskom even though it brought a new plant on stream at Newcastle more than a year ago.

Bukula says that a separate system operator's office, backed by the necessary government guarantees is expected to take over the buying role but he could not say when this division would be operational. In order to be granted a licence, Independent Power Producers must show they are:

- Using an acceptable and proven technology;
- Have the ability to alleviate power shortages;
- Are well-placed to connect to the grid;
- Use an acceptable and standardised agreement;
- Provide some benefit to the previously disadvantaged people of South Africa;
- Have complied with advanced environment impact assessments;
- Have the ability to raise the necessary funding to build and run a power plant;
- The plant can be commissioned in a reasonable time and will use smaller rather than larger generators to provide electricity;
- Generate employment for the local community.



## An auspicious centenary year says du toit Grobler

The South African Institute of Electrical Engineers experienced a particularly auspicious year in 2009/10 when it celebrated its centenary according to du toit Grobler, immediate past president of the organisation.

In his president’s report, presented at the annual general meeting of the organisation held at Neotel’s auditorium in Midrand at the end of March, Grobler paid tribute to Victor Murray Wilson who fell ill just before the end of his term as president of the institute and sadly passed away on 17 November last year after a long battle with cancer.

Grobler says that in recognition and remembrance of Vic, a Fever Tree or Acacia Xanthophyllous was planted on the north western side of Innes House by his wife, Christa van Schalkwyk.

Highlighting aspects of his year in office, Grobler paid tribute to Ian McKechnie, who was president of the SAIEE in 2007, who stepped in to fulfil the responsibilities of the immediate past president and as an office bearer after the passing of Vic Wilson.

“My theme for the year was: The SAIEE – a century of achievement behind us and a century of challenges ahead of us and this set the scene for the many centenary celebrations that were held during the year,” said Grobler.

The following events were celebrated during the year:

- Presidential addresses at all the centres and interest groups in April and May;
- The president’s invitation lecture at the Kingsway Campus, the University of Johannesburg and at the KwaZulu-Natal Centre where Jack van der Merwe, head of the Gautrain Project spoke to delegates about the high speed train and the impact it will have on commuting patterns between Johannesburg and Pretoria.
- A centenary celebration held at Innes House in June where the keynote speaker was the Minister of Science and Technology, Naledi Pandor. At the event a plaque commemorating 100 years of the SAIEE was unveiled.
- A charity golf day held at Pretoria Country Club where a total of R23 889 was raised and donated to the Maria Kloppers Child Care.

The Bernard Price Memorial Lecture saw Professor Bill Gruver discussing the impact of intelligent systems being developed for the world and his paper was presented at all centres and interest groups throughout the country rather than just in the main centres of Johannesburg, Durban and Cape Town.

A special commemorative book entitled The First Ten Decades – This History of the SAIEE 1909-2009 and compiled by Mike Crouch was launched at the Museum of Military History in Saxonwold, Johannesburg.

The Institute’s centenary banquet was held at Wanderers in November and where the guest speaker was Trevor Manuel, Minister in the Office of the President.

In addition the SAIEE held its centenary conference at the Sci Bono Development Centre with a theme: Engineering the Next 100 Years: Impact of Future Electrical and Electronic Technologies and unveiled a thermal imaging display at the centre.

“It really was an eventful year with two breakfast briefings held at the Johannesburg Country Club in Woodmead, an international symposium on high voltage held at the Cape Town Convention Centre.

Referring to the application by Eskom for its 35 percent increase in electricity tariffs each year for the next three years, Grobler said that the National Energy Regulator had determined not to grant Eskom’s request and award the organisation tariff hikes of 24,8 percent, 25,8 percent and 25,9 percent instead.

“This was in part due to the strong representations made at the public hearings by the SAIEE and many other organisations who objected vociferously to the extensive price hikes that Eskom wanted to impose on all South Africans,” said Grobler.

At a specially organised SAIEE colloquium on the supply of electricity in South Africa, Eskom’s managing director of system operations and planning Kannan Lakmeharan, who is also a senior member of the Institute, presented a paper entitled The Electricity Supply and Demand balance in South Africa with a specific focus on the FIFA World Cup 2010.



du toit Grobler congratulates Mike Crouch for his dedicated service over the past ten years.



New SAIEE President, Angus Hay is congratulated by du toit Grobler at the Institute’s annual general meeting at the end of March.

Grobler told members at the annual general meeting that the Africa Research Journal was now up-to-date and paid tribute to the work done by managing editor Dr Saurabh Sinha. He also paid tribute to the editorial staff of WATTnow, particular the co-operation and dedication of Karen Grant, deputy publisher at Crown.

He said that following on discussions with Crouch the SAIEE had taken the decision to publish the first Annual Transactions of the SAIEE, which will accurately document events that have occurred during the year under review.

“Membership of the Institute has been steadily growing and there are now 5 185 people who are playing an active part of this voluntary association, which is a sign that we remain a vibrant organisation that continues to attract professional people into our ranks,” he said.

Referring to the relationship that the SAIEE has with other associations, Groble said that a memorandum of understanding has been signed with the Institute of Electrical and Electronic Engineers (IEEE) that will allow members of the SAIEE to benefit from reduced

fees if they attend the International Communications Conference in Cape Town in May.

The SAIEE is in the process of renewing its relationship with the Institution of Engineering and Technology’s South African network and a memorandum of understanding has been signed between these two organisations. Pierre Ballot and Bruce Jackson represent the SAIEE at the South African National Energy Association.

In terms of the Engineering Council of South Africa, the SAIEE is still playing an active role in this organisation and six members of the 2009-2013 council appointed by the Minister of Public Works Geoff Doidge were either nominated by the SAIEE’s Council and/or served on the SAIEE’s Council.

Grobler paid tribute to the various office bearers, council members, members of committees and staff members at the SAIEE for what he termed their “dedication and commitment” to the institute over the year.



du toit Grobler paid tribute to Ian McKechnie who stepped into to fill the vacancy caused by the death of Immediate Past President Victor Wilson.



Elize du Toit, receives a bouquet from the Michelle Hay as a token of thanks for her work with the SAIEE during the Centenary year



President Angus Hay congratulate new Deputy President Andries Tshabalala on his election.



Angus Hay welcomes Paul van Niekerk to the presidential ranks. Paul was elected as a Vice President of the SAIEE.



## SAIEE welcomes World Bank decision

The South African Institute of Electrical Engineers (SAIEE) welcomes the World Bank \$3.75bn loan to Eskom to fund a portion of the 4,800MW Medupi Power Station.

Constructing new coal-fired power stations is one of only a few medium-term, practical, economically-viable alternatives that will meet the growing demand for electricity in South Africa's developing economy. Power stations on this scale are important to address the projected base-load power requirements, which current renewable technologies simply cannot do. Nuclear power is also an option, and should certainly be pursued over the longer term, but is not possible in this time frame and at this capital cost.

In addition to the obvious benefits of the project to the development of the country as whole, the project will contribute significantly to the development and retention of key engineering skills. Although experience shows that the need for construction of new power stations is cyclical, there has been a substantial hiatus in South Africa over the past few years, and this resumption creates much-needed demand for various engineering skills, from professional engineers to artisans. It also creates important opportunities for training and experience.

The construction of a modern coal-fired power station, making use of the latest desulphurisation technology to minimise emissions, is certainly better than some alternatives. During the load-shedding in 2008, there were suggestions that every home or office in South Africa would need an environmentally-unfriendly diesel generator to ensure continuity of electricity supply. South Africa's electrification programme over the past twenty years stands out as an example to many countries, with over 9 million of South Africa's 12 million households now having electricity. This has made a substantial impact on the quality of life of South Africans, whilst dramatically reducing pollution from the burning of paraffin, coal and wood.

According to Dr Angus Hay, President of the SAIEE, "The SAIEE strongly supports the move towards a sustainable future based on environmentally-friendly development, and electricity forms a critical

part of this future. Without electricity, much of what we regard as the modern world, from the Internet to the Gautrain, simply cannot function. On balance, the construction of Medupi Power Station, albeit coal-fired, is positive for the country.

We certainly support the alignment of Eskom's procurement process with the World Bank's guidelines, which include environmental requirements. It is also important to note that a portion of the loan is earmarked for the development of a 100MW wind farm, and a 100MW concentrating solar plant."

During the recent NERSA public hearings on electricity tariffs, the SAIEE strongly supported the need for additional Eskom generation capacity. However, this needs to be part of a package of measures, from independent power producers, to demand-side management and improvements in maintenance, as well as ongoing technological improvements, including smart grid technology, and renewables such as wind, solar, wave, and hydro-electric power such as the mooted Inga power plant on the Congo River.

South Africa's world-class academic institutions continue to make important contributions to these improvements, through research and development in the field of electrical engineering, and its electrical engineers will play an important role in their implementation.

The South African Institute of Electrical Engineers is a professional association representing the interests of electrical and electronic engineers, certificated engineers, technologists and technicians in Southern Africa. Its 5000 members are professionally engaged in the full range of engineering activities, including academic research, manufacturing, electronics, telecommunications, measurement and control, mining, and power infra-structural services.

For over a century, the members of the SAIEE have made important contributions to the quality of life of the community and to the steady advancement of technology. The Institute contributes to the common interests and welfare of the whole engineering fraternity through close co-operation with the Engineering Council of South Africa (ECSA).

## Fraud uncovered at the SAIEE

The South African Institute of Electrical Engineers has uncovered a rather excessive extent of fraud and misappropriation of funds at its office in Johannesburg.

According to auditors PriceWaterhouseCoopers, an employee at the SAIEE stole R703 452 through various fraudulent transactions and a further amount of R234 320 has been identified as possibly being linked to further fraudulent transactions.

The employee has been suspended and charged but until the investigations are complete the SAIEE is not going to identify the person responsible at this stage.

Commenting on the issue, du toit Grobler said that the SAIEE had hope to finalise the matter before the end of the financial year but

because of the nature of the transactions it unfortunately has to be carried over into the 20010/11 financial year in order for the auditors to complete the forensic audit that is already underway.

PriceWaterhouseCoopers says that because the forensic audit is still underway the impact of this fraud on the financial statements could not be established.

"The SAIEE takes this matter very seriously and the discovery of the illegal financial transactions are being treated as such. The forensic investigations are well advanced," he added.

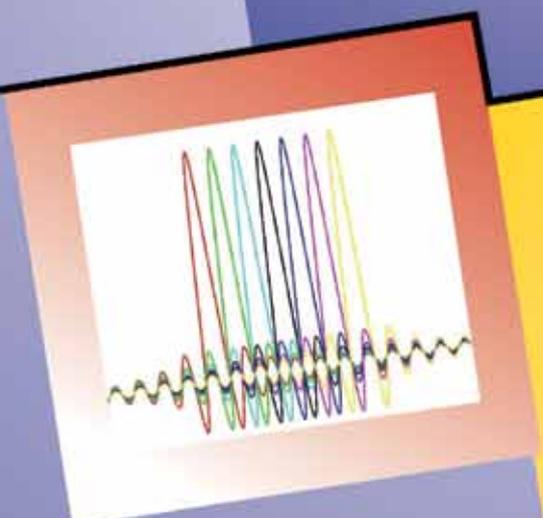
"A Special General Meeting will be held at a later date as soon as the internal and external investigations are completed and a full report will be provided to members of the SAIEE," he said.



# POWER LINE COMMUNICATIONS: University of Johannesburg

## Our Research Interests

Powerline Communications  
Digital Communications  
Coding Techniques  
Information Theory  
Video Communications  
Networks



## Our Research Partners

University of Duisburg-Essen, Germany  
Technical University - Delft  
University of California (Davis)  
Walter Sisulu University  
North-West University  
University of Witwatersrand  
Chinese University of Hong Kong  
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Telecommunications Research Group  
Electrical and Electronic Engineering Sciences  
Faculty of Engineering and the Built Environment  
University of Johannesburg  
P.O. Box 524  
Auckland Park  
2006

Phone: +27 (0)11 559 2147  
Fax: +27 (0)11 559 2357  
E-mail: [hcferreira@uj.ac.za](mailto:hcferreira@uj.ac.za)  
[pvanren@wsu.ac.za](mailto:pvanren@wsu.ac.za)  
[tgswart@postgrad.uj.ac.za](mailto:tgswart@postgrad.uj.ac.za)  
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