WATTnow

Be Enlightened

The Cosatu pipedream – or a day in the life of dreamers

South Africa needs a huge investment in its distribution network

Viagra and porn for pandas

Petrol engine smaller than a finger-tip

Official Magazine of

SAIEE

November 2010

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Could Cosatu's dreams materialise?

Much of what the Congress of South African Trade Unions (Cosatu) has outlined in its blueprint for the future is really laudable.

For instance, South Africa does need to change its education system and have better teachers teaching children who want to learn and are disciplined and determined enough to attend classes every day.

It does need to re-introduce proper artisan training and have squadrons of qualified and skilled men and women earning a living through decent jobs where they have learned to do a particular task and to do it well.

South Africa does need to have a much stronger knowledge base and does need to inject more and more funds into the tertiary education systems. It does need a strong group of academic researchers who are capable of driving development for the future.

All of these things are contained in the Cosatu document outlining its view of the future for the country.

But where things start to go wrong is that while the dreams and ideals are easy to commit to paper, they need to be backed up with some kind of concrete, feasible suggestions on how such pipedreams can be achieved.

That's where Cosatu's document, in my opinion anyway, falls over. Transforming South Africa into a socialist state, providing mass nationalisation of industries and economic sectors and insisting that all workers have the full protection of permanent employment is nothing short of absurd.

The economy just doesn't have the financial muscle to provide that at this stage. Yes, if there is significant economic growth for a sustained period then it might have that kind of muscle. But right now it doesn't.

Let's look at some of the other anomalies that Cosatu does not address. Strike action for one. It was firmly behind the strike by teachers earlier this year knowing full well that it would have severe implications for the future of the school children who were being victimised by their actions.

Similarly, it is Cosatu that demands that we maintain the ridiculous labour relations laws that are designed to protect workers at all costs. The labour legislation is exactly why there are so many labour brokers operating in this country and why so many workers can only be employed through these labour brokers.

Look at the costs of setting up a new business in South Africa and the costs of compliance for employers. This bureaucracy is, in itself, a real barrier to entry and one that Cosatu wants to maintain – and in certain areas even increase.

So I don't really understand why anyone would take the Cosatu plan for the future too seriously – and I think that is a great pity because many thousands of people throughout the country look to it for some inspired leadership.

For them Cosatu may be the key to change – and if we look at the work of unions and union federations in other parts of the world it is certainly true that workers are a force to be reckoned with.

But I do think that Cosatu should provide some realism for the people of this country. Not necessarily by doing things the way that they have always been done before – for that doesn't represent change anyway.

I would prefer to see them come up with practical recipes for change that will improve the very things they want improved: education, jobs, more research and greater levels of prosperity.

And you don't make anyone rich by taking money away from the rich.

Instead you just impoverish both groups.

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WATTnow

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WATT'S

WATT'S HAPPENING

5> WATT'S GOING ON?

Scientists create world's first 'super-twisted' light; PneuDrive Challenge gets underway; Matching Theory – why unemployment levels remain high even when job offers are plenty; Kayema wins Energy Company of the Year; Online learning continues to surge; SA students win green talent award.

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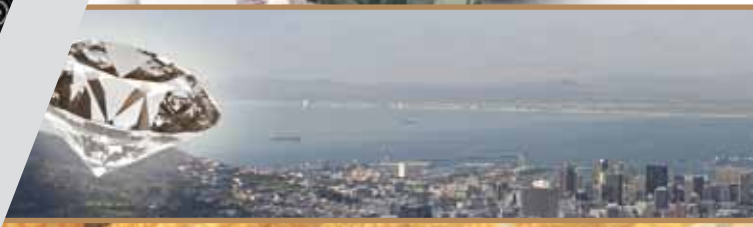

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Mentorship

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 personal situation, having been there him- or herself.

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

The mentor and mentee could arrange to meet regularly, 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 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 or 011 487 9050,

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

Scientists create world's first 'super-twisted' light

Glasgow scientists have created 'super-twisted' light for the first time. The research team at the University of Glasgow twisted the light like a corkscrew by using a polarising filter, before shining it onto a specially shaped piece of gold to create the world's first 'super twisting'.

Super twisted light does not exist in nature and, until now, it had only been theorised by scientists, never produced. Super twisted light can be used to find protein traces in incredibly small samples of biological material like blood, far less than currently used. The researchers have already used the light to look at many different proteins and have found that it is particularly sensitive to the structures of proteins which cause degenerative diseases such as Alzheimer's and Parkinson's Disease. The findings have been published in Nature Nanotechnology. Dr Malcolm Kadodwala, senior lecturer in the School of Chemistry, said: "We are very excited by this research. Essentially, this twisted light, which does not exist naturally, allows us to detect biological materials at unprecedented low concentrations. "Due to the nature of the twisted light, it has been shown to be particularly effective at detecting proteins with a structure characteristic of amyloids – insoluble proteins that can stick together to form plaques within different organs in the body. "It is these plaques which are thought to play a part in neurodegenerative diseases such as Alzheimer's, Parkinson's and CJD – though the reasons for this are unclear.

"We're now looking to see if this same technique can be adapted to detect a wider range of proteins which are indicative of other diseases. The fact this method requires much less material (just one picogram or million millionth of a gram) for analysis than current techniques and uses a form of light previously unrealised is a big step forward." The complex science behind the technique takes advantage of the fact that light can be twisted like a corkscrew by passing it through a special polarising filter: in much the same way as polarised sunglasses allow only certain alignments of light waves through.

By shining light onto a specially-shaped piece of metal – in this case gold – the light that is emitted from the metal becomes super-twisted.

Polarised or twisted light is already used in some medical techniques to analyse biomolecules, however the multidisciplinary Glasgow team have been able to achieve a much more powerful system by twisting the light even tighter.

The team included engineer Dr Nikolaj Gadegaard and life scientist, Dr Sharon Kelly, with a team of physicists at the University of Exeter, led by Dr Euan Hendry. The use of super-twisted light in spectroscopy – the analysis of materials according to the way they absorb and emit light – has numerous potential applications in biosensing and could also be used to detect particular types of viruses which have similar structures.

PneuDrive Challenge gets underway

The PneuDrive Challenge is entering its fourth successful year and is open to engineering students from all South African universities.

Up for grabs is an all expenses paid trip to Germany as well as the donation of SEW Eurodrive and Festo equipment.

"The challenge this year is for students to design innovative applications in the food and beverage industry", comments Rene Rose National Marketing Manager for SEW Eurodrive and spokesperson for the PneuDrive Team.

The competition is jointly sponsored by SEW Eurodrive and Festo who are both well known for their innovative motion control solutions. The products are often found working side by side in the food and beverage applications. The competition has been endorsed by SAIMechE and SAIEE.

Stellenbosch University has scooped top honours in the competition for the last three years. Other participants include UJ, UCT, UKZN, CPUT, NWU and Wits Universities.

More information on the competition can be found at www.pneudrive.co.za. The PneuDrive Challenge can also be followed on the popular social networking websites, Facebook and Twitter.

Universities who would like to participate are welcome to contact the PneuDrive team on info@pneudrive.co.za or rrose@sew.co.za

Matching Theory - why unemployment levels remain high even when job offers are plenty

By Gavin Chait

"According to a classical view of the market, buyers and sellers find one another immediately, without cost, and have complete information about the prices of all goods and services... But this is not what happens in the real world," reads a statement about the work of Peter Diamond, Dale Mortensen and Christopher Pissarides, who have won the 2010 Nobel Memorial Prize in Economic Sciences.

The area of economics known as 'search theory' is the study of people's strategies when choosing from a series of potential opportunities of random quality, when delaying choice is costly. These economic models attempt to calculate the cost of postponing a choice against the cost of going out and continuing to search.

The reason this is important is because of unemployment.

In the aftermath of any major economic disaster, governments and central banks attempt to "prime the pumps"; they release large amounts of cash into the economy and lower interest rates in order to lower the cost of hiring and increase consumption. When it works, companies borrow to hire on the strength of increasing consumer expenditure.

Except that there is also jobless growth. Sometimes economies start to turn around, employers offer jobs, but unemployment remains stubbornly high.

Search theory would have it that a person looking for a job should accept any offer within a particular reservation wage zone; a measure of an upper and lower limit acceptable to them. In practice this doesn't happen.

The 'new' economics, only now emerging, builds on the concept of bounded rationality. Most of our formative economics assumed that, as information became available, participants to an economy would respond to that information. This formed the foundation for the rational-agent economics of much of the twentieth century.

'Bounded rationality' was first expressed by polymath and economist, Herbert Simon, in his 1957 book, Models of Man. "Boundedly rational agents experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information," he says.

He introduced the concept of 'satisficement'; that people make do. All of this may sound like common sense, but the earlier models existed precisely because complexity is so hard to model mathematically.

Simon suggests that economic agents employ the use of heuristics to make decisions rather than a strict rigid rule of optimisation. They do this because of the complexity of the situation, and their inability to process and compute the expected utility of every alternative action. Deliberation costs might be high and there are often other, concurrent economic activities also requiring decisions.

Rational-agent theories assume that information asymmetries resolve once all the agents have access to the same information. Simon's theories suggest that the asymmetries may never resolve but may simply settle at a new equilibrium point in which some agents 'pretend' that they have all the information.

Daniel Kahneman, professor at Princeton University's Department of Psychology, built on this to create Prospect Theory. It allows one to describe how people make choices in situations where they have to decide between alternatives that involve risk. Since all these theories have to do with social interactions they're grouped together as Behavioural Economics. Many of the models are now tested in Game Theory and other mathematical approaches.

Consider one particular game known as the Marriage Supermarket. Finding a partner is not particularly different from securing a job. It's a matching problem; you need to consider a range of jobs, decide which you prefer, and then persuade the employer that you are the perfect match (or vice versa).

How this works out depends very much on who is playing the game.

In our Marriage Supermarket, twenty single men and twenty single women are shopping. The rules of the game are simple: any men and women who present themselves at the checkout can collect $100 and leave. In game terms, the $100 acts as the return on investment you receive from a match and an incentive to conclude a match. In such an equally matched game the couples will soon pair-off and head out having secured $100.

This is a simplistic model. However, most people would rather be in a relationship than be single. There are certainly exceptions but they tend to be statistically irrelevant. Why people want to be in partnerships varies, but we're not especially interested.

In the first game, couples would be likely to split their $100 50:50. How much do you think the game will change if 19 men turn up for 20 women?

Clearly one woman is going home single. What may be less obvious is that all the other women are going home with less than they expected as well. Even a small amount of scarcity changes the dynamics of these social interactions completely.

Imagine that a couple is heading to the till for their $100; the one woman being left behind will tackle them there. Right now each party to the couple is getting $50.

The single woman has an incentive to offer to take a smaller share. Perhaps she

offers to only take $40. A bidding war will soon erupt until the lucky chap is heading out the store with $99.99 in his pocket while his partner has accepted one cent.

The problem doesn't end there. The supermarket is a transparent market and so the price for all the other women in the shop just plunged as well. 19 women got one cent, and one woman got left behind.

A modest shortage of partners created a massive disruption to pricing. Now extend that to jobs and you get a fair idea of why economies become so unstable when subject to seemingly limited problems.

The heavy-lifting of economic strategy is pretty much in place in the more developed economies but now the subtleties of these matching asymmetries continue to have free reign.

Managing an economy is a little like taking up running. It is relatively straightforward to achieve a base level of fitness but, once you start racing, you need to concentrate more on technique, equipment and diet. Losing by one second is still not first.

Governments wishing to reduce long-term unemployment must have the patience and honesty to tackle structural problems that increase friction. Like winning marathons, full employment takes application, guts and determination.

The problem, though, is that these marginal problems have catastrophic consequences. Worse still is that governments then want to reverse all the successful strategies they've already implemented. A bit like the fat person who lost weight and improved his fitness and diet in order to win marathons and didn't ... and then decided that losing weight and getting fit was actually the problem. After all, he'd never lost a race until he competed and he only competed because he lost weight.

What Diamond, Mortensen and Pissarides identified is that there can be friction in the job-search process which leads to an extended period of matching.

For starters, the jobs may not be available anywhere near where the jobless live. A person unencumbered by responsibility or debt may choose to move immediately in search of those jobs, but only if they know about them.

A person with a big mortgage on a house that is worth less than the debt on it may feel that it is better to stay and find a job nearby. Selling the house would leave the person without an asset but with painful debts.

In other words, while searching for a job has costs, so does selecting one. If the costs of matching your needs to a new opportunity are too great you might not take a job that pays what you want even when it's offered.

Counter-intuitively, a person may voluntarily remain unemployed for fear of the costs involved in taking on a new job.

Identifying the problem means that we can try and fix it. Governments could offer financial support to people whose 'under water' mortgages prevent them from selling and moving.

Economists have now looked for other costs that can create friction in the search process. Frictions can be subtle, such as women not working since the cost of childcare leaves a family worse-off than if she weren't working. Others include unemployment benefits that are higher than potential wages, the costs of gaining or maintaining skills, or simply high taxes on income.

These frictions may not only affect job seekers. Employers can also experience friction. High regulatory costs of firing a poor employment choice may lead to lengthy interview processes. Employers will delay making a choice, even on a crucial position, in order to ensure that the candidate is 'perfect'. Trying to support increased employment is then a matter not just of creating economic stimulus but also of identifying these frictions and removing or reducing them. Consider whether giving an asymmetrical number of participants in the Marriage Supermarket will solve the problem of one person being left behind. If we raised the stakes to $200 through a fiscal stimulus, all that would happen is that the blokes would now get $199.99 and the women would still get one cent each. One woman still remains single.

On the other hand, if that single woman was plucked from the market and delivered to a different market that was evenly matched then both markets would stabilise. The woman herself may not know about the other markets and so it becomes the job of the external agent to either investigate or manufacture alternative markets. There's a lot to digest in matching theory. It means that many governments must reconsider their approach to economic stimulus. If the lessons are learned then, hopefully, fewer of us will be going home empty-handed.

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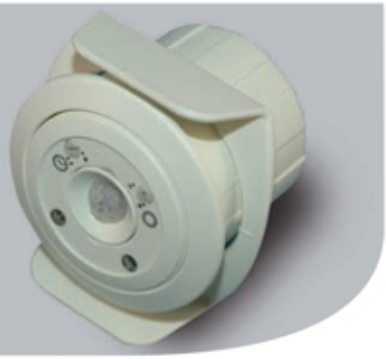
How intelligent controls combine savings and comfort

- Lighting consumes an astonishing 19% of the world's electricity generation. The resulting CO_2 is equivalent to 70% of global emissions from passenger vehicles and is three times more than emissions from aviation.
- However, lighting offers various opportunities to reduce your energy bill.

3 efficiency solutions for your building:

1 Light only when you need it
– Occupancy Sensing

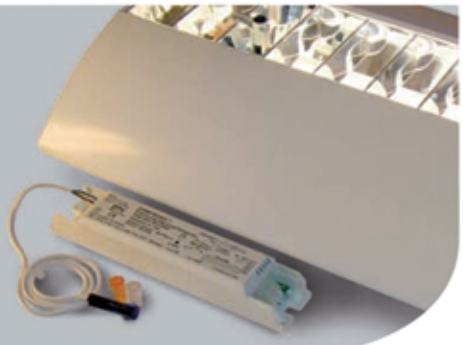


Have you ever noticed how often the lights are left on when a room is not in use? Major improvements in sensitivity and reliability have transformed the primitive "Motion Sensing" approach into a high-comfort Occupancy Sensing.

Occupancy Sensors automatically turn lights on when a room is occupied and off when a room is vacant. Saving energy could not be easier.

Typical applications include offices, conference rooms, bathrooms and storage areas.

2 Use only as much light as required
– Dimming, especially Daylight Dimming



In most buildings the lights are on at full intensity all day even when plenty of daylight is available. This is a waste of energy and causes unpleasant overlighting.

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Kayema wins Energy Company of the Year

Johannesburg-based Kayema Energy Solutions won the SAEE's Energy Company of the Year Award in recognition of its outstanding achievements in the energy industry. The award was presented at the SAEE annual banquet held at Emperors Palace in November, where the SAEE Convention and Exhibition for 2010 was formally opened. Kayema general manager, James Shirley, was elated with the honour bestowed on his company and immediately credited his team by saying, "This is something all our team can celebrate, having played their part in winning."

Competition for the award was tight, but the overall motivation, together with the long-term benefits that Kayema's projects will have in contributing to the energy security of South Africa, ultimately resulted in Kayema scooping the award.

The company has a domestic and commercial division. The projects commissioned by Kayema in 2010 will reduce electricity consumption by an estimated 850 000 kWh per year. Measurement and verification processes are not always performed on domestic project savings, however using a calculation of an average of 8 kWh per day, Kayema's high-end system installations for 2011 could achieve savings of over 7,3-million kWh per year, with a 20 year life-cycle guaranteed for 10 years.

"That is equivalent to 10 medium-sized solar farms and these figures do not include the savings made through various insurance company replacement schemes, which are currently being piloted," he said.

With over 40 years' experience developing solar water heating systems, and the backing of majority shareholder Group Five Construction, Kayema offers a strong network of solar water heating professionals for their SABS approved and internationally certified products.

As an accredited supplier for the Eskom demand-side management programme with access to solar water heating system rebates, and the company's project finance offering, Kayema places access to renewable energy in reach of the Southern African community.

The SAEE annually recognizes the outstanding accomplishments of individuals and companies in the energy field through the SAEE Awards Programme. The award is a token of recognition for the commitment to the profession and the desire to further the association's mission, as well as for the participation in civic and community affairs.

Online learning continues to surge

More than five million students enrolled for online courses in 2009 as more and more students benefit from the accessibility and convenience that online learning offers, claims Ian Yoell, regional director of Edexcel Southern Africa.

He says there is widespread global debate about the value of online learning compared with more traditional methods, because while electronic learning methods offer flexibility and improved one-on-one interaction, traditional methods, with pre-arranged schedules, set assignments and group interactions, still provide learners with the infrastructure needed to sustain effective education.

South Africa's educational sector recently launched an interactive telematics online learning programme and 14, 000 matriculants used this system to engage and interact with lecturers via satellite links.

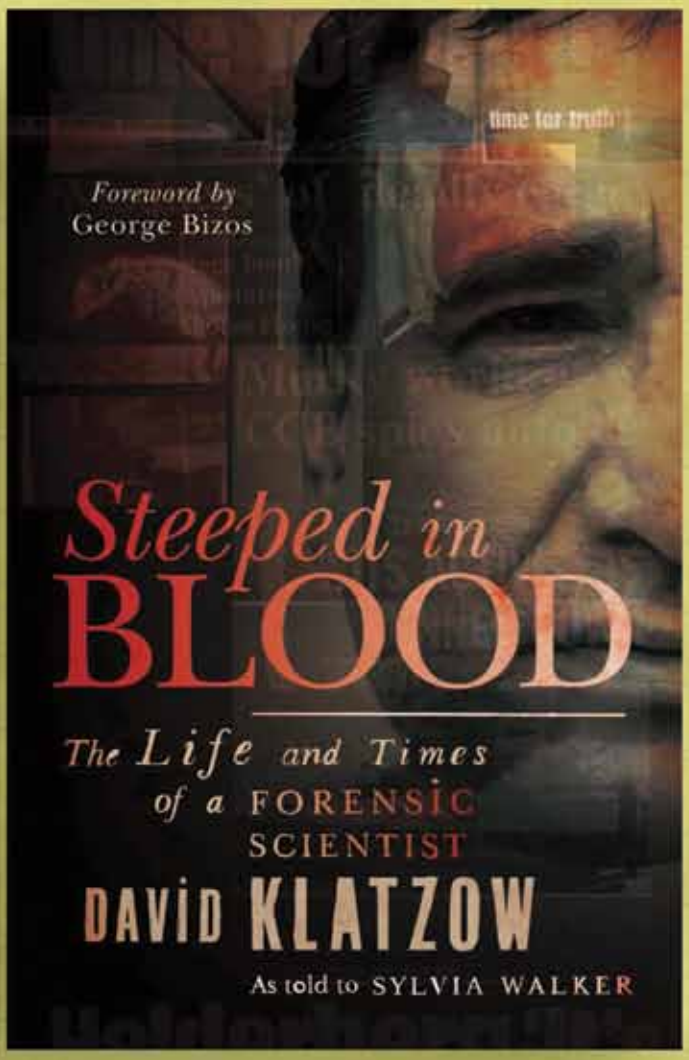
Yoell says, in the South African context, this online learning system should be viewed as a supplementary tool and support structure for students. He says it is neither superior nor less effective than traditional methods.

"Though research substantiates online learning to be largely positive, learners and educators should not ignore its constraints," says Yoell. For students who opted for online learning, Yoell has outlined recommended strategies for success:

- Students must set definitive goals at the beginning of the course, divide the material into manageable and realistic segments and set achievable targets.
- Accountability is increasingly important in bringing the digital learning experience into the physical realm.
- Students should join a study group, identify a learning style, celebrate any successes and ask as many questions as necessary to understand the concepts.

Yoell predicts over the next five to ten years, mobile education, personalised learning and the collection and application of relevant data and technology will influence and improve educational outcome and ultimately shape the face of e-learning.

'Distance learning does not render traditional methods obsolete. As technology evolves, education will develop alongside it. The method or channel of instruction does not determine success. Students need to learn in an environment best suited to their needs and capabilities, whether traditional, online or mobile,' he says.



Steeped in Blood – The life and times of a forensic scientist

Bloody crimes of passion, political assassinations, sinister poisonings, investment fraud and mass mining disasters ... Dr David Klatzow has seen it all. During his extraordinary twenty-six-year career as South Africa's foremost independent forensic scientist, he has investigated countless high-profile and notorious cases.

Steeped in Blood provides gripping accounts of dozens of these matters, including the infamous deaths of Brett Kebble and Inge Lotz, the Helderberg aeroplane crash and the frustrating investigations of the brutal apartheid years. From the Gugulethu Seven and Trojan Horse massacres to the assassination of David Webster, Klatzow's investigations reveal his fierce determination to unveil the truth in spite of overwhelming state obstructions, police bungling and cover-ups. Unfazed by controversy and unwilling to accept no for an answer, Klatzow's tenacity, fearlessness and forensic know-how are used to brilliant effect in these fascinating cases.

AVAILABLE: OCTOBER 2010

This book exposes a demanding and sinister world where the rewards are equalled only by the frustrations, and where the truth is always elusive. But the truth is out there, and David Klatzow will find it.

About the Author - David Klatzow

Dr David Klatzow is an internationally recognised forensic scientist. He is an expert in the field of pyroforensics and an authority on blood alcohol. Before branching out into the world of forensic science, he was a lecturer in biochemistry at the University of Durban-Westville and medical biochemistry at the University of the Witwatersrand.

About the Author - Sylvia Walker

Sylvia Walker is a marketing manager in the financial services industry with a passion for writing and a keen interest in the world of crime. Her first book, Dealing in Death, was published in 2009 and focuses on tik and the plight of parents who live with addiction.

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SA students win green talent award

German Federal Minister of Education and Research, Professor Annette Schavan, honoured two young South African researchers with this year's "Green Talents" international sustainability award for their research. She received the altogether 20 award winning research entries from 12 countries at the 7th Forum for Sustainability of the Federal Ministry of Education and Research (FONA) in Berlin. "We are extremely pleased about the great response the 'Green Talents' competition once again received this year and about the participants' interest in Germany as a research location," said Minister Professor Annette Schavan. "The purpose of this competition is to advance international cooperation so we can jointly contribute towards developing sustainable solutions to fighting the climate change and to protect the environment." Minister Schavan pointed out: "We create conditions that let us learn with and from one another. Most importantly, we do not want to make decisions over the heads of the young people themselves whose future is the issue here, but together with them."

The award of the Federal Ministry of Education and Research (BMBF) under the patronage of Minister Professor Annette Schavan is handed out for the second time in 2010. It is a distinction for outstanding scientific talents in the field of sustainability research. The decisive selection criterion is that a research paper may crucially contribute towards mastering global challenges such as the climate change, declining energy resources and massive environmental pollution. Paul William Jorgensen from the university in KwaZulu-Natal impressed the jury with being so focused on studying the topical issue of ecosystem goods and services at his young age. Jeanne Yvonne de Waal is currently pursuing her PhD at the University of Stellenbosch and swayed the jury with her research in the field of biology-based pest control.

A total of 234 young scientists from 57 countries had applied to become one of the "Green Talents", among them 18 researchers from South Africa. A high-calibre jury of German experts selected a total of 20 award winners who will travel through Germany from 1 to 11 November 2010 as part of a ten-day science forum. Germany is one of the leading locations for sustainability research in the world and a strong partner for international cooperation arrangements in this field. During their stay in Germany, the "Green Talents" are going to visit important universities, research institutions and companies and will learn about trend-setting projects in various fields of technology. They will meet renowned German experts and establish contacts with young German scientists. Moreover, after the week of the Forum, the award winners are going to have the opportunity for an additional stay of up to three months within one year to do research in Germany in order to further intensify the international exchange in the field of sustainability research.

The winners of "Green Talents – The International Forum for High Potentials in Sustainable Development 2010":

"Green Talents 2010" from South Africa:

(Mr) Paul William JORGENSEN (South Africa), BSc (Hons), BSocSc, MSc-Student, University of KwaZulu-Natal, South Africa, research focus: quantification of ecosystem goods and services

(Ms) Jeanne Yvonne DE WAAL (South Africa), MSc, PhD-Student, University of Stellenbosch, South Africa, research focus: sustainable agriculture "Green Talents 2010":

(Ms) Janaína ACCORDI JUNKES (Brazil), MSc, PhD-Student, Federal University of Santa Catarina, Brazil, research focus: waste management – reuse of mineral waste

(Mr) Tirthankar BANERJEE (India), PhD, G. B. Pant University of Agriculture and Technology, India, research focus: environmental modelling

(Mr) Sukalyan BHADRA (India), MSc, PhD-Student, Indian Association for the Cultivation of Science, India, research focus: development of sustainable catalytic systems

(Mr) Alexander GUSEV (Russia), PhD, Nizhny Novgorod State Linguistic University, Higher School of Economics, Russia, research focus: energy policy

(Mr) HE Zhen (Jason) (China), PhD, University of Wisconsin, USA, research focus: bioenergy recovery from wastewater

SEITE 3 (Ms) Indumathi JEYACHANDRAN (India), PhD, University of Utah, USA, research focus: urban systems sustainability

(Mr) Tonni KURNIAWAN (Indonesia), PhD, University of Eastern Finland, Finland, research focus: water treatment / water purification

(Ms) Adriana Patricia LÓPEZ VALENCIA (Colombia), MRes, PhD-Student, Universidad del Valle, Colombia, research focus: sustainability of human settlements

(Ms) Bee Ting LOW (Singapore), PhD, Membrane Technology and Research, Inc., USA, research focus: membranes for CO2 capture

(Mr) Andrew MARCH (USA), BSc, MSc-Student, Université d'Orléans, France, research focus: environmental hazards to urban centres

(Ms) Daniela MORAIS LEME (Brazil), MSc, PhD-Student, Universidade Estadual Paulista, Brazil, research focus: environmental impact of biodiesels

(Ms) Julia NIKITCHENKO (Ukraine), MSc, PhD-Student, National Aviation University, Ukraine, research focus: recycling of scrap tyres application of secondary raw materials

(Mr) Mike OTIENO (Kenya), MSc, PhD-Candidate, University of Cape Town, South Africa, research focus: sustainable cement and concrete materials

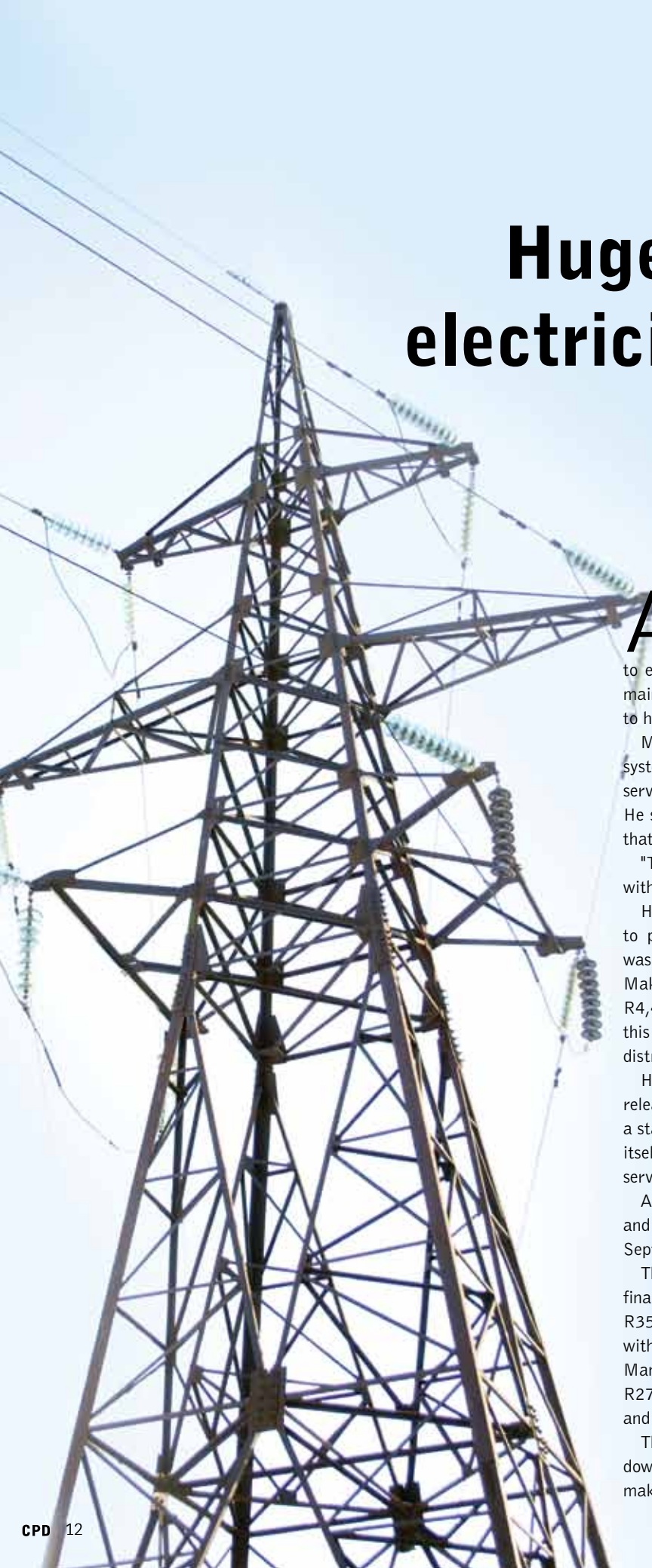
(Mr) PHAN Vu Xuan Hung (Vietnam), MSc, Gwangju Institute of Science and Technology, Korea, research focus: water and wastewater treatment – desalination and photovoltaics

(Ms) Binita SHAH (India), MSc, Freespanz Design Build Pvt. Ltd., India, research focus: holistic sustainable development framework

(Ms) Mercedes VALDERRAMA-VERNAZA (Colombia), Dipl, Universidad Industrial de Santander, Colombia, research focus: ecosystem research and sustainable land use

(Mr) WANG Chao (China), MSc, Beijing Union University, China, research focus: solid waste treatment methods

(Mr) ZHAO Dewei (China), MEng, PhD-Student, Nanyang Technological University, Singapore, research focus: organic solar cells



Huge investment in electricity distribution needed

by Paddy Hartdegen

According to Simphiwe Makhatini, chief director of the Department of Public Enterprises, South Africa will have to spend R32,4-billion on its energy distribution infrastructure to ensure the network remains reliable. He stressed investment in maintenance was critical to maintain a reliable supply of electricity to homes and businesses throughout the country.

Makhatini said that a reliable electricity generation and supply system was needed to promote economic growth, increase delivery of services, create jobs and ensure proper use of the country's resources. He said that several municipalities were facing financial strain and that this made it difficult for them to maintain the network.

"The distribution industry in South Africa is in a dilapidated state with one third of municipalities financially unsustainable," he said.

He urged users of electricity, including businesses and industries to pay their electricity bills because non-payment for electricity was increasing the financial strain being faced by local authorities. Makhatini pointed out that South Africa was currently losing about R4,4-billion a year to theft of equipment and electricity and that this was further undermining the ability of councils to maintain the distribution network.

His comments come at a time when, according to recent figures released by the National Treasury, South Africa's councils are owed a staggering R37,7-billion by household consumers; the government itself owes R3,4-billion in unpaid bills for electricity and other services.

Astonishingly, the total aggregated consumer debt to municipalities and metropolitan authorities was R62,3-billion at the end of September this year.

The budget statement for the first quarter of the 2010/11 financial year showed that metropolitan municipalities were owed R35,4-billion, an increase of R3,9-billion or 12,4 percent compared with the same period last year. In percentage terms, the Nelson Mandela Bay council's debtor book increased by 16,5 percent to R275-million, while Ekurhuleni rose by 15,1 percent to R1,1-billion and Cape Town by 11,8 percent to R558-million.

There have been reports that the government is considering closing down EDI Holdings although the Department of Energy has yet to make any firm proposals about this state-owned enterprise.

EDI Holdings was set up to facilitate the restructuring of the electricity distribution industry and to create regional electricity distributors (REDS).

The municipalities in South Africa have largely been united against the formation of independent regional distributors, claiming that the distribution industry is inefficient and fragmented anyway. Distribution of electricity is fragmented between Eskom and 187 different municipalities throughout the country. Under the restructuring plan, the distributors were supposed to be reorganised into six REDs but there has been little progress on this plan since it was first mooted in 2003.

According to the Department of Energy's spokesman, Bheki Khumalo, the decision to close EDI Holdings has not yet been taken although there have been widespread reports from unnamed government sources that the decision has been made. Apparently this view is based on the fact that President Jacob Zuma's cabinet has taken a decision to withdraw a bill to amend the constitution relating to the existing rights and duties of municipalities that distribute electricity.

At this stage, the distribution industry in South Africa is worth about R33,5-billion and it has assets valued at about R30-billion. It employs just over 30 000 people throughout the country. Earlier this year, Minister of Energy, Dipuo Peters, told the National Council of Provinces that EDI Holdings had spent R62-million on ring-fencing the electricity distribution assets that will eventually be incorporated into the REDs.

Peters claimed that the state of readiness for the consolidation of 187 municipalities and electricity distributors had reached "its highest level ever" through the signing of Accession to Cooperation agreements with these entities. She said that 30 municipalities, together with Eskom, constituted about 90 percent of the entire electricity distribution industry in South Africa.

There have been sustained efforts to restructure the electricity distribution sector but the biggest stumbling block seems to come from local authorities, which derive a substantial amount of revenue from electricity distribution, particularly in the larger councils. The result is that as this year draws to a close, there is still no meaningful progress on setting up regional distributors and there is no clarity on the future of EDI Holdings, tasked with the programme for restructuring.

The major problem remains that as the different municipalities, the Department of Energy, Eskom and EDI Holdings bicker over the future of electricity distribution the existing network becomes more dilapidated and will require excessive investment to bring it back up to the standard it was prior to the restructuring plans.

EDI Holdings itself has said that there are many problems facing electricity distribution in South Africa, the most important being that there is a constant theft of underground cables, theft of electricity and the fact that there is no philosophy of payment from users, many of whom insist that they should receive free electricity.

According to a statement from Jonathan Ross, the shadow deputy minister of energy for the Democratic Alliance, the Cabinet is believed to be considering whether to dissolve EDI Holdings. Ross has also said that he intends to submit a range of questions to the Department of Energy regarding the future of electricity distribution in South Africa.

He says that EDI was mandated by the government to oversee the spending of an estimated R25-billion backlog in maintenance but had not done so. He says that the possible decision to dissolve EDI has placed the future of electricity provision to all South Africans in jeopardy and that this shows that the government's plans seem to be directionless at this stage.

Apart from the municipalities, several independent analysts have also questioned the practicalities of setting up an independent distribution infrastructure, and Ken Robinson, senior executive for resources at Accenture, says the REDs concept in its current form is not appropriate for South Africa. He says consolidation is necessary for the industry and recommends that many of the smaller municipalities be amalgamated into the Eskom distribution infrastructure or incorporated into larger municipalities.

So, while the future of the REDs seems as uncertain now as it was when the plan was mooted, the clear fact remains that significant investment in maintenance of the existing network is of paramount importance when it comes to keeping South Africa's lights shining.

The history of the mobile phone

By Gavin Chait

On 3 April 1973, a man walking along a busy street stopped amidst the river of people and did something no one had ever done before. He hoisted a large brick of plastic, weighing over a kilogram, up to his ear and spoke into it.

"Joel, I'm calling you from a 'real' cellular telephone: A portable handheld telephone." The recipient of the call was Joel Engel, head of Bell Labs. The person speaking, with a big infectious grin on his face, was Martin Cooper and he had just made the world's first cellular phone call.

In December 1947, engineers Douglas Ring and W Rae Young at Bell Labs proposed a concept of hexagonal cells for mobile phones in vehicles. Philip Porter extended the concept by proposing that the cell towers be at the corners of the hexagons rather than the centres. Each tower would have directional antennas that would transmit and receive in three directions into three adjacent hexagon cells.

Bell's concept was dedicated for motor cars. The towers were extremely high and required tremendous power for transmission, especially from the phones. There was a reason for this height. Cellular phones had no mechanism for handing over calls from cell to cell. If you lost connection to the tower where your call had been initiated your call dropped. A person couldn't carry that number of batteries and so Bell bonded the phone to a car.

Yet, despite being the source of many mobile patents, the US was slow to roll out its concepts. To give you a sense of why, consider that AT&T submitted its proposal for an Advanced Mobile Phone System (AMPS), which included frequency reuse and call handoff, to the Federal Communications Commission (FCC) in 1973. It took almost a decade before the FCC gave its approval in 1982 for the 824-894MHz frequency range.

The patchwork quilt of regulatory red tape crushed the industry and meant that, while patents would continue to flow out of the US, implementation in Europe and Japan would influence and shape standards and technology.

The first automated mobile phone system for vehicles was launched in Sweden in 1960. The company responsible was one founded in 1876 by Lars Magnus Ericsson. Ericsson delighted in taking apart inventions by Siemens and Bell, reverse engineering them and then building his own cheap copies.

However, Cooper and his team's invention at Motorola was the one that would revolutionise telecommunications.

The first generation of mobile phones (1G) was able to use multiple cellular zones and to successfully transfer calls from one cell to the next as the caller moved during a conversation. The first network was launched in Japan by NTT in 1979. Tokyo was blanketed with 23 base stations and 20 million people became the first targeted customers. By 1981, Denmark, Finland, Norway, Sweden, Mexico, Canada and the UK all had fledgling 1G networks.

The US finally rolled out a commercial service in 1983. The phones were Motorola's DynaTAC 8000X, based on Martin Cooper's original 1973 prototype. Each phone would cost the equivalent of $9,000 in today's money; which is why Gordon Gekko – Oliver Stone's mythological symbol of capitalist greed – uses one in the 1987 film, Wall Street.

As more and more subscribers joined, more towers would be added into the cellular network. This permitted more data to be carried but also for the towers to drop in height and serve a smaller range. As that happened the battery power required to operate a phone could drop.

While battery technology has certainly developed the largest contributor to increasing talk-time, from a mere 30 minutes in 1983, has been the increasing number of transmission towers. There are limits to how many calls can be served via these analogue 1G systems. In 1982 the European Conference of Postal and Telecommunications Administrations created the Groupe Special Mobile (GSM) that would work on a universal standard for cellular communications. In 1990 phase I of the GSM specifications was published. We call this 2G.

The first GSM network was launched in 1991 in Finland by Radiolinja and Ericsson. By 1993 over a million subscribers were using GSM in 48 countries. GSM transmission divides call frequency bands into multiple channels so that more than one user can place a call through a tower at the same time. A key feature of GSM is the Subscriber Identity Module; your SIM card. This is a smart card that contains the user's subscription information and a phone book. It permits you to switch handsets on the GSM network.

Time Division Multiple Access (TDMA), one of the standards for GSM, requires rigidly enforced timeslots to avoid interference with alternative calls. Frequency DMA requires similar monitoring of adjacent channels to avoid Doppler shift in the signal spectrum as users move around.

This imposes an upper limit on the number of parallel calls that GSM can permit in a single cell since each of these slots must be fixed.

In 1995 an alternative standard was introduced in the US; Code Division Multiple Access (CDMA). This allocates a fixed code to each user that encodes their signal. A protocol of handshaking between transmitter and re-

ceiver allows the signal to be decoded. Since the number of codes can be almost infinite, CDMA towers can carry an unlimited number of parallel users. There is a trade-off. In the US this has been implemented as a locked phone code, which explicitly limits the phone for use on a single network. If a subscriber wishes to change she or he will need the agreement of both the old and new carriers.

This has proven popular in the US where more than 60 percent of the network runs on CDMA and 37% on GSM. In the rest of the world GSM accounts for 87% of the market. This is largely as a result of the ease of shifting your SIM which has allowed billions of poor telephone users in the developing world to share phones.

This is also why both Apple, with the iPhone, and Microsoft, with the Windows Mobile Phone 7, have limited their phones to AT&T and T-Mobile's GSM network in the US while leaving Verizon and Sprint without cover.

Consider that Apple's success has come without the ability to sell its device to more than half of US consumers and you'll get a sense of what a lift Apple will experience in 2011 when it finally offers CDMA phones.

GSM also introduced a new standard for Short Message Systems (SMS). The main idea for SMS was that messages could be transported on the signalling paths needed to control telephony traffic during time when no such traffic existed. To ensure that the messages wouldn't get in the way they were limited to 128 bytes (later improved to 140 bytes or ... 160 characters).

Since this was merely an upgrade to the existing system SMS was rolled out to all GSM phones with a software upgrade. No one thought it would be particularly important. The first SMS message was sent over the Vodafone GSM network in the UK on 2 December 1992. Neil Papworth of the Sema Group sent a message to Richard Jarvis of Vodafone: "Merry Christmas".

In 2008, 4.1 trillion messages were sent and the service was worth over $81 billion that year.

The next big technological jump was 3G, which permitted a wider range of mobile services, most especially mobile Internet. To qualify as 3G according to the IMT-2000 specification, a network must offer simultaneous use of speech and data services, and provide peak data rates of at least 200 kbits per second. By this stage governments knew that mobile services were going to be huge. There was a finite spectrum available for transmission, so how best to value this? The UK government invented a new type of auction in 2000.

It worked as follows: each bidder would declare their current bid in each round; should they wish to drop out they must physically leave the auction; they will be held to the current price for three additional rounds even if they don't bid. Five licences were sold for an astonishing $35 billion and almost crippled the "winners". They weren't the only losers. Gordon Brown, then UK chancellor, squandered the money on benefits to his nation, driving up the national debt and leading indirectly to the crash of 2008.

According to the UN, five billion people use mobile phones worldwide. 250 million of those phones are one model: the Nokia 1100. The phone is hardly sophisticated. It has a tiny screen, plastic buttons and few services. Yet it is astonishingly robust and caters to the vast market at the bottom of the economic pyramid. Its success has gone hand-in-hand with the influence of prepaid contracts. Prepaid was patented in the US in 1994 and subsequently rolled out across the planet.

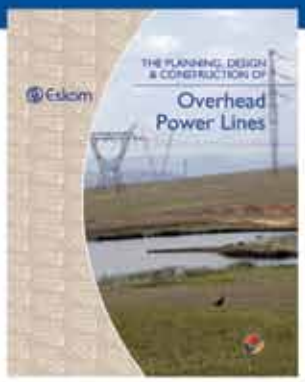
Along with this success has gone the mobile financial service. More than one billion people use mobile banking. M-Pesa is the world's most successful and was launched in Kenya in March 2007.

On 29 June 2007, the first iPhones went on sale in the US. People queued up overnight as if this mass-produced consumer item were a bunch of scarce concert tickets. Within 30 hours Apple had sold 270 000 of them.

Apple's success has driven renewed interest in smart phones with slick interfaces. Google's Android was released in 2008 and Microsoft released the Windows Mobile Phone 7 in November 2010. The smartphone segment of the market has sold approximately 100 million phones across all manufacturers since the release of the iPhone. All of this has happened in a mere twenty years. Douglas Adams, writing in 1999, pointed out how young we are in adapting to all this technology. "Before long, computers will be as trivial and plentiful as chairs and we will cease to be aware of the things. In fact I'm sure we will look back on this last decade and wonder how we could ever have mistaken what we were doing with them for 'productivity.'"

And the last words go to Martin Cooper: "Wireless is freedom. It's about being unleashed from the telephone cord and having the ability to be virtually anywhere, when you want to be. That freedom is what cellular is all about. It pleases me no end to have had some small impact on people's lives because these phones do make people's lives better. They promote productivity, they make people more comfortable, they make them feel safe and all of those things. In the sense I had a small contribution there makes me feel very good. "

Dr Martin Cooper re-enacting his 1973 call on a Dyna TAC 8000X in 2007.



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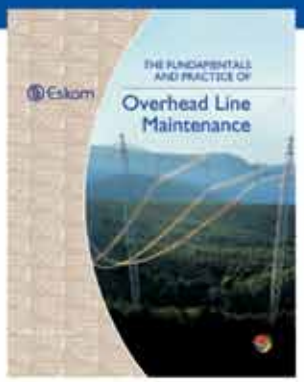

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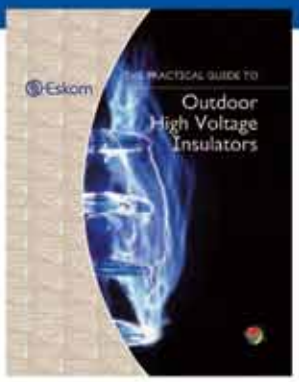

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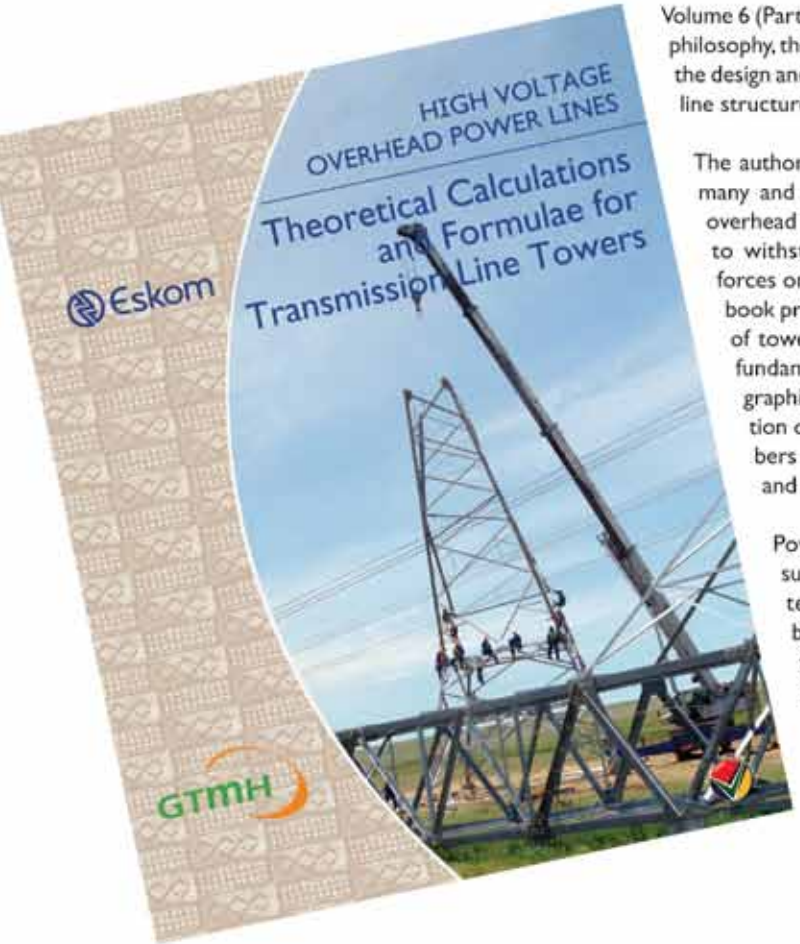

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Power line towers are routinely subjected to full scale mechanical testing and the book concludes by describing the procedures followed at major test stations around the world.

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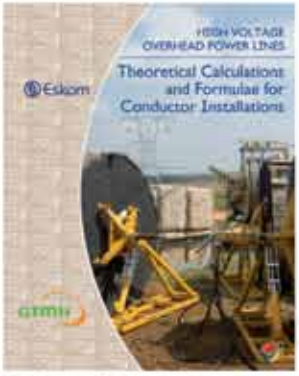

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Cyber-espionage, online fraud, a major threat

Cyber espionage and online fraud are two of the most urgent security threats facing companies today, according to the findings of a report from Ovum, one of the world's leading research consultancies.

Graham Titterington, Ovum's analyst and author of the report on security threats facing businesses, says that other priorities that need to be tackled by companies throughout the world are the protection of intellectual property and compliance methods that will help to prevent corruption.

He says that businesses must not under-estimate the extent of cyber crime because the criminals are large-scale organisations that are well organised, well funded and well resourced.

"The criminal network is intent on defrauding millions of people and thousands of companies around the world," he says.

He warns that any of the new technologies, such as cloud computing, while providing many benefits for companies, bring with them a whole range of new threats.

"The main thrust of security should be on protecting assets rather than defending perimeters," he says. "Moreover, state-sponsored cyber attacks are a threat to the commercial world, about which our government should be as concerned as other governments are right now," he says.

He says examples of state-sponsored attacks against commercial organisations include the strike against Google in China earlier this year. There have, according to the report, been similar attacks on at least 34 companies in the United States and more and more of the Fortune 500 multinational organisations are being targeted.

Titterington recommends that companies adopt a risk management strategy that allows them to manage threats when they become a risk rather than trying to limit the impact once the attack is underway.

He says that vendors have a responsibility to provide some leadership within the security environment so that vulnerable data can be protected.

Powermat – the answer for those damned gadgets

South Africa's rapidly growing number of mobile devices will all benefit from a revolutionary wireless battery charging mat that sets new standards in convenience and efficiency while having minimal environmental impact, and certainly less than if all the devices were plugged in separately. Platinum Micro, a leading distributor of various electronic devices has been appointed the sole South African distributor for the Powermat wireless charging device, which will soon be on sale via various retail organisations. "The Powermat has caused a stir all over the world," said Platinum Micro product manager, Tyrone Gruner. "It is one of the most convenient ways to charge the wide variety of mobile devices available on the market today and it's literally become a household name in the US."

The Powermat consists of a charging surface or 'mat' which is plugged into a wall socket, and a variety of different cases, add-ons and peripherals that are equipped with a magnetic Powermat receiver. The receiver is attached to a device and placed on the mat whenever a battery re-charge is required. Gruner said the Powermat system does the rest, charging mobile devices more quickly than their bundled chargers and, unlike other methods of charging, does little, if any, damage to mobile device batteries.

"It is a combination of Powermat's magnetic alignment system and RFID tagging that delivers these benefits. Using a magnet located inside the Powermat receiver, the system is able to more accurately align devices on the inductive charging surface. This ensures a higher quality charge is delivered and that batteries more quickly reach the full mark." The RFID identifies each Powermat receiver's model and the device it corresponds to. Gruner said this ensures the exact voltage and wattage of power, required to optimally charge that device, is delivered.

"Powermat's charging solution is also more environmentally friendly than other solutions, since it shuts power off the moment a device reaches a fully charged state. This not only saves energy, but it also prevents overcharging of the device's battery, which can shorten battery life. "It is the most convenient, efficient and green battery-charging solution available in South Africa today and we expect the market to pounce on it the moment stock arrives."

Platinum Micro plans to stock the entire range of Powermat charging mats and receivers. "We're convinced this line of innovations will be a huge success," said Gruner. "The Powermat concept offers the freedom and convenience of charging mobile devices without plugging, unplugging and wiring tangles and searching for mislaid chargers." Four different and incompatible electronic devices can be charged simultaneously with one power cord. Three of the devices can be placed on the mat surface and the fourth can be charged using the USB port at the back of the mat – simple, quick and clean.

Leica for the keen amateur photographer

Imagine a camera with a 25 mm to 600 mm in 35 mm format that took exceptional photographs providing you with over 14 megapixel resolution and the look-and-feel of a digital single lens reflex?

Well that's what you get when you buy the newly-launched Leica V-Lux2, the newest offering from one of the oldest and most respected camera manufacturers in the world.

The 24-fold super-zoom lens is suitable for macro-photographic applications in one mode and then can be used for impressive, high-speed sport actions photographs with a quick flick of the zoom adjustments.

It has a three-inch liquid crystal display for video capture and playback in 1080 full HD and comes with an integrated stereo microphone with electronic wind suppression.

In its high-speed burst mode, bursts of 11-frames-a-second can be captured at the full resolution of 14,1-megapixels or at 60-frames-a-second at 2,8 megapixels, making it one of the world's fastest consecutive-shooting cameras.

Its Leica CMOS image sensor is finely tuned to bring out the best of the Vario-Elmarit 108 mm f/2.8 to 5.2 SAPH zoom and, in combination with the camera's electronics, provide brilliant, high-contrast images with natural colour and superb sharpness.

The integrated handgrip makes it possible to handhold the camera when working at its full 600 mm zoom.

The Leica V-Lux 2 is available in South Africa at a price of around R10 000.

Microsoft tries Orchestrated Freedom and unleashes an innovation army

By Gavin Chait

Microsoft is due to release its hope for recovering credibility in the smartphone market. Windows Phone 7 will have a tough job. Apple's iPhone is the benchmark for style and sophistication. Google's Droid phones are now widely distributed and have overtaken US sales of the iPhone.

The critical factor for many in buying a smartphone is now the availability of applications to run on this poly-communication and entertainment device. Apple's 100 million iPhone owners have made five billion downloads of some 200 000 different applications.

That disguises a lot of asymmetry. The top 10 percent of paid applications dominate and have made most of the $1.5 billion spent on such software. The most popular are established games companies like Electronic Arts and Activision, as well as a few independent developers. Many of the independents—like Tapulous, producers of Tap Tap Revenge, now owned by Disney—are being bought out by the majors.

Microsoft has taken advantage of this consolidation by paying the most popular developers to port their software across to Windows Phone 7. Microsoft is now going further. The company's 90 000 employees will each be receiving a new Windows Phone 7, and a little extra. Employees at most companies are subject to strict anti-moonlighting provisions. Anything you develop while an employee becomes the property of the company you work for. Unsurprisingly, this tends to limit innovation.

Faced with the choice of receiving no benefit from a potentially lucrative idea, or having to quit a secure job in order to develop it further, most people opt to stay put and do nothing. Great ideas never happen because employees are unwilling to part with them unless rewarded.

Microsoft has now opened the floodgates. Any employee who creates applications for the new phone will keep all the benefits of that creation. Microsoft doesn't want any part of it. This is a long-awaited innovation: orchestrated freedom.

Companies are permanently in search of innovation and ways in which to motivate their staff to spur such creativity. At the same time they encumber their employees in a drowning morass of red-tape that stifles their freedom. Corporate ambition is channelled upwards into fulfilling mandatory targets that can result in career advancement. Pay increases come from climbing the corporate ladder to higher positions of authority, not from innovation.

A person who identifies a way to increase the efficiency of a work process for everyone gets little by way of compensation. A person who regularly over-achieves his/her personal delivery targets—no matter how inefficiently—can get a performance bonus and a promotion.

Many companies have attempted to stimulate innovation through skunk works or permitted bootlegging. Permitted bootlegging is research time where technical staff are allowed to spend a certain amount of their time working on 'pet-projects' in the hope that, some day, there is some return for the company. Skunk works are a little different, being a group within an organisation given a high degree of autonomy and unhampered by bureaucracy, tasked with working on advanced or secret projects. Skunk works are funded, permitted bootleggers are not.

The famous examples of bootlegging include Post-it Notes, where Art Fry created the ubiquitous yellow note-pads after being introduced to a low-tack, reusable adhesive developed by his colleague, Dr Spencer Silver, a chemist at 3M.

The most famous current proponent of bootlegging is Google, which has set aside 20 percent of its employees time for 'Innovation Time Off'. However, such promotion must be aligned with employees needs if it is to be successful.

In 2001 Shuji Nakamura famously sued Nichia Corp for two billion yen. His patent for the blue LED, which consumes less energy than regular light bulbs, helps rake in over 50 billion yen a year in revenue for Nichia Corp, where Nakamura worked for 20 years. But Nakamura only received 20 000 yen for each of the dozens of patents on inventions he developed at Nichia. He quit in 1999 and took a job with the Materials Department at the University of California, Santa Barbara. He ultimately received compensation of 840 million yen (approximately $9 million) in 2005.

In the Harvard Business Review, Chris Trimble of the Tuck School of Business takes issue even with Google's much hyped endeavours. "It sounds expensive. Very expensive. For sake of argument, let's say 60 percent of the cost structure in your organisation goes to salary and benefits. If you were to allocate 20 percent of each person's time for innovation, it would immediately cut 12 points from your margins. Twelve points! Even if you cut it down by extending the 20 percent policy only to a subset of employees, those are huge numbers. Could it be worth it? Will the investment pay off in the long run?"

Google claims the fruit of its innovation programmes are Gmail, Google News, Orkut and AdSense. Orkut is a failure, Gmail and News don't do anything for their revenues, and the entirety of Google's income depends on AdSense. Given that Google has 23 000 employ-















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ees, how is its continued policy working for it?

Google's employees cost around $2.6 billion a year; 20% of that is $520 million a year. Google can certainly afford that, but what ideas are worth an investment of that much money? In addition, random idea generation is just that, random.

"The problem with the 20 percent policy is that it's likely to generate a great deal of activity on the idea side of innovation and very little on the execution side—the other side. Think about it. Just how much can one person accomplish with 20 percent of his/her time? They might be able to complete some very small projects, but if we're talking about anything significant—a new product, a new service, or a brand new businesses—then 20 percent of one person's time is just not much to work with," says Trimble.

It goes further than just the time and money. Not everyone is cut out to be innovative and entrepreneurial, just as not everyone is cut out to surpass performance targets. If companies genuinely wish to unleash the potential for innovation in some of their employees they have to take creative steps.

That also means aligning the objectives of the company with the creative endeavours of those employees wanting to innovate.

"Real bootleg entrepreneurs do not care whether bootlegging is permitted or not, or if the firm expects open communication," says a report by Research Technology Management. "At Becton Dickinson, total transparency strikes them as an unrealistic demand and driven by wishful thinking on the part of management. At 3M, only few people make use of permitted bootleg time. It is generally only the divergent-thinking researcher who actually can make proper use of this time. This number is further decreased by another factor. When managers know about permitted bootleg projects, they will ask about them, thus affecting the researcher's sense of freedom."

Innovators are supported when barriers to personal reward are removed. Innovators can assert their creativity only when both their independence is recognised and their networking interconnections outside corporate confines are supported.

The question is not, "How does one motivate people?" It is how do companies relate their own ambitions to the natural motivations of their internal innovators?

Companies also have to recognise that not all 'innovation' is going to be inspirational. I'm willing to bet that right now a Microsoft employee is developing an application that makes inappropriate farting noises.

Like free speech, not all innovation is strictly noble. Some is just teenage exuberance and some is outright horrifying.

In Google's case, the company is spending its own money to promote ideas, the vast bulk of which are a waste of time. Yet it seems to regard this as a genuine business strategy.

Microsoft, on the other hand, is simply trying to counter Apple and Google's lead in mobile phone application development. The vast majority of both companies' apps are uninspiring, but advertising "We have 200 000 apps" is a real winner for Apple. Microsoft has permitted its staff to make money out if its platform and what it gets in exchange is a rapidly growing application universe.

Orchestrated freedom is about allowing stakeholders to innovate as they choose and encouraging their alignment with your objectives by rewarding the most successful.

Microsoft's objective is clear. Google's is not. Unfortunately, where objectives are unclear, success becomes immeasurable. It is this misalignment that continues to trouble most business support for internal innovation. In addition, innovation can be terribly disruptive of existing business systems and processes. Staff who come up with something truly unique, and faced with internal objections, are likely to simply leave and try their idea outside. The profits and success then accrue to the individual alone.

South Africa's great example of that is Raymond Ackerman who put his creative new ideas about retail into action for himself in Pick 'n Pay only after being fired from his job as director of Checkers, precisely for trying to promote his ideas there.

It remains to be seen whether Microsoft will go far enough to make this work and whether it will continue allowing such freedom once its objectives have been met.

If it does it could be a wonderful new tool in corporate strategy.

The Cosatu pipedream – or a day in the life of dreamers

I love pipedreams about as much as I enjoy brainstorming sessions, think-tanks and other creative mechanisms aimed at finding solutions to the myriad problems that face South Africa.

The reality is that so few of these pipedreams, brainstorming sessions, think-tanks or indabas ever translate themselves into something that is really valuable for society, that will contribute to the welfare of the nation or will help to eradicate the widespread corruption and mismanagement that is so endemic in our country.

So when the Congress of South African Trade Unions released its latest outlook for the South African economy in a document quaintly entitled A growth path towards full employment I was keen to read it.

Much of what Cosatu has to say makes good sense and, I really do hope that its recommendations will be picked up and transformed into a reality for the country as a whole. But the sad fact of the matter is that while the ideas, notions, sentiments and expressions are wonderfully idealistic, they have about as much practical value as offering a group of vegetarians a prime rib burger for lunch.

The next fundamental point is that Cosatu represents workers and, as such, it has the workers' interests at heart. I am a worker – not one of the privileged ruling-classes of bosses – and so I was keen to see what Cosatu wanted to achieve for the workers and it's here that we hit the first snags.

Cosatu says, quite correctly, that to a large extent the state remains insensitive to the plight of the working class majority and claims that the policies of the past 16 years have failed to deliver tangible material progress for these workers.

The report states that the working class has been severely marginalised from participating in, or staking its claim to, the economy in a number of ways including unemployment, flexible labour markets, casualisation, outsourcing and the use of labour brokers. What Cosatu doesn't say (but is something that needs to be considered) is that South Africa's own labour legislation has led to the development of these labour brokers, has contributed to the increase in outsourcing and has caused a degree of casualisation of the labour market.

Many labour experts have pointed out that South Africa's labour legislation is perhaps the most liberal in the world and is aimed at providing extensive levels of protection to workers. In fact it is so all-forgiving that it is almost impossible to fire somebody without first going through a series of onerous procedures first. The legislation is so protective that prospective employers can actually be sued for not giving somebody a job. It is in these practical areas where Cosatu seems to lose its focus because idealism overtakes any practical implementation of its ideas. It says, for instance, that wages have been deliberately suppressed despite productivity gains.

"All these factors are meant to break the power of the working class, increase the power of capital and to boost the profitability of the capitalist system to support economic growth." Well, Cosatu's a trade union federation so you can't be surprised by the fact that it thinks all workers are marginalised and all bosses are evil capitalists who are just exploiting them. But Cosatu does make a very good point: The inequality in income, power, poverty and unemployment is stark. Moreover, its figures show that 1,1-million jobs were lost between 2009 and 2010 resulting in R35-billion being lost in employees' income given that the average wage is R33 713.

The net effect of these job losses is that 5,5-million people have been plunged into poverty at a time, it says, when income distribution has worsened. It cites ten factors that are wrong in terms of the post-1994 growth path as set out and pursued by government:

- Unemployment among Africans was a 35% in 1995 but rose to 45% in 2005 while among all South Africans it was at 31% in 1995 but increased to 39% in 2005. In 2009 the number of Africans in the workforce accounted for 52% while for whites it was 68%. It also says that among Africans aged between 15 and 64, only 36% are absorbed into the workforce while among whites this percentage is 65%. In trotting out these figures, Cosatu makes no mention of the failures of the education systems, the lack of on-the-job training or any of the other prerequisites that employers have when opening up new job opportunities but, be that as it may.
- Cosatu says, quite correctly, that the unemployment levels remain high. By 2007, Cosatu says, 12-million people were relying on grants from government, up from just 2,5-million in 1999 and then goes on to assert that this is evidence of the government's anti-working-class character of its post-1994 growth path. "The economy reproduces poverty and the state throws money at the problem, without intervening to change its structure," says the Cosatu document. The organisation might well be right too.
- It claims that the redistribution of income has not occurred and points to the fact that there has been a decline in the income of African households between 1995 and 2005. The share of employees participating in the national income was 56% in 1995 but this had declined to 51% by 2009. In 2007 about 71% of African female-headed households earned less than R800 a month and 59% of these had no income. At the same time, 58% of African male-headed households earned less than R800 a month and 48% had no income. It says that even the Minister of Finance, Pravin Gordhan admits that 50% of the population lives on 8% of the national income.
- In 2008 the top 20 directors of listed companies on the Johannesburg Stock Exchange earned an average

of R59-million each, while the average earning of an employee was just R34 000. It says that the top 20 directors of state-owned enterprises experienced a 59% increase in earnings, collectively raking-in R132,2-million or R6,6-million per director, which is 194 times the average income of the South African worker. It claims the average African man earns R2 400 a month while the average white man earns R19 000. The average that white women earn is R9 600 a month compared with just R1 200 a month for African women. It cites a great many more anomalies: 56% of whites earn no less than R6 000 a month while 81% of Africans earn not more than R6 000 a month. It goes on to say that inequalities have increased most among the coloured population.

- Predictably, Cosatu is highly critical of the fact that, it says, power is concentrated in "white capitalist hands" with black ownership of listed companies ranging between 1,6% and 4,6% of the stock exchange. It says that just six companies account for 50% of the JSE and more than 80% of the JSE is accounted for by large banks or companies at the core of the minerals-energy-complex. "Crucial sectors in the economy continue to be dominated by a few large conglomerates with cross directorships," says Cosatu.
- It says the South African economy's structure is mineral dependent and finance-led. Petrochemicals, mining and iron and steel make up 69% of total exports and these sectors are capital and energy intensive. Imports continue to be made up of sophisticated manufactured items such as machinery and equipment.
- Predictably, Cosatu says that control of the economy remains in white hands with top management and senior managers being drawn from the white population group. It goes on to say that 45% of top management promotions went to white males and 17% to white females in 2008. This, it says, is an indictment of the socio-economic quality of South Africa's democracy.
- The health profile of the population has deteriorated and, in 2006 a black female could be expected to live for 12 years less than a white male. The average white male living in Sweden could expect to live for 30 years more than the black South African female. In 1992 the life expectancy of South Africans was at its highest at 62 but this has now fallen to 48 years for black people and 71 years for whites who will live for 23 years more than their black counterparts.
- Cosatu points to the decline in education standards as a fundamental problem in South Africa and says that 70% of matriculation examination passes are achieved by just 11% of the country's schools. Cosatu's major concern is that 12-year-old South Africans perform three times less than 11-year-old Russian children when it comes to reading and 16-year-olds in South Africa perform three times less than 14-year-olds in Cyprus when it comes to mathematics. Cosatu says that white learners' performances are in line with international standards in both science and mathematics but this is twice the score of African learners. Only 3% of children who enter the schooling system eventually complete it with higher grade mathematics while only 15% of Grade Three learners pass both numeracy and literacy tests. More than 70% of schools do not have libraries, 60% do not have laboratories and 60% of school children are pushed out of the system before they reach Grade 12. More than 55% of educators have indicated that they would leave the profession if they were able to do so.
- Cosatu says that while there has been progress on the housing front, with 74% of South African households living in brick structures, flats and townhouses, there are still 1,87-million people living in shacks. It says that 46% of South African households live in dwellings with no more than three rooms while 17% live in one room. Among Africans, 55% live in homes with three rooms and 21% live in a single room. By comparison 50% of white households live in dwellings with no less than four rooms.
- It says progress has been made in terms of meeting basic needs as the number of households with no access to water fell from 36% in 1994 to just 4% in 2009. In terms of access to sanitation, this improved from 50% to 77% in the same year and access to electricity increased from 51% to 73%. Predictably, Cosatu does object to the high costs of electricity and says that a number of communities have engaged in service-delivery protests partly inspired by low quality of services, partly by a lack of services and government neglect and partly because of cut-offs because of the cost-recovery policy on basic services. It says that about 1,5-milliion households, affecting about 5-million people have had their water cut because of non-payment. It blames low income, unemployment and high costs for the cycle of non-payment.

Cosatu says that the past 16 years have shown that the ballot box, although necessary, is not a sufficient path to power and no policy shift will emerge unless it is preceded by a shift in class power in society. It says the basic tenets of the current neo-liberal poicy can be summarised as:

- Trade liberalisation
- Financial liberalisation
- Labour market deregulation
- Limited role of the state
- Fiscal austerity
- Tight monetary policies
- Central bank dependence

It says that trade liberalisation is promoted to enhance South Africa's international competitiveness but adds that between 1995

CPD Overview

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and 2008 the secondary sector of South Africa's economy lost 350 000 jobs. Similarly, it says, financial liberalisation led to the rise of speculative financial activity creating fictitious capital accumulation rather than real capital accumulation.

It says the removal of exchange controls facilitated the outflow of capital and major South African conglomerates moved to the London Stock Exchange including Gencor, Liberty Life, Anglo American, De Beers, Old Mutual, SA Breweries, Investec and Didata. It claims these companies have now found a way to eschew, or deliberately avoid, the responsibilities of financing industrial diversification in South Africa.

Cosatu may not be wrong in its contentions, but it goes on to say that the rapid rise in South Africa's foreign debt, from $25-billion in 1994 to $78-billion in 2008 has seen little productive investment in the private sector. In five years, South Africa's share of foreign capital inflow in total savings rose from zero in 2001 to 75% by 2008 and this makes the country's economy vulnerable to capital flow reversals, entrenching the power of global financial capital, which may then be able to hold domestic policy hostage.

Cosatu claims that the labour market flexibility in South Africa contributes to increased worker vulnerability because it disrupts the workers' abilities to organise themselves and this, in effect, drives down real wages.

Wearing its union hat, Cosatu says that labour market deregulation makes it impossible to combine employment with significant skills development because of the precarious nature of employment. It says that in 2009, labour brokers controlled 30% of employment in South Africa's labour market.

Cosatu then criticises inflation-targeting as a basic monetary policy and even if the population voted for an expansionary fiscal stance, the central bank can independently sabotage the government by setting real interest rates above the growth rate of the economy, making public debt explode faster than would otherwise be the case.

Furthermore, it says, the removal of the 'printing press' as a source to finance developmental government expenditure constrains the public sector to raise funds using public debt, and to increase taxes and tariffs to essential services such as water, electricity and transport. It says that by removing the central bank from democratic ownership and control, it is in a position to make it easy for conglomerates to co-ordinate private interests.

Based on these key assertions, (there are others) Cosatu says the policies of the past 16 years have failed to challenge the power of the conglomerates and have, in fact, strengthened their stranglehold on South Africa. It blames government policy for failing to diversify the economy as well. So Cosatu recommends a new growth path for the country based on what it calls the Six Pillars for New Growth. It says the neo-liberal experiment of the past 16 years has exacerbated the fundamental problem of the exploitative tendencies of capitalism. It wants a wage-led and redistributive economy that will increase wages in real terms and improve income distribution.

It says a redistributive growth path will create decent work and be pro-poor. Moreover, redistribution must encompass economic power because the economy currently pays 1 728 times the average wage of a worker to a person who happens to be a director. The Cosatu redistribution plan comprises:

- Redistributive fiscal policy to deliver social infrastructure (education, health, housing, water, sanitation and energy), economic infrastructure to support industrial development and social security.
- Monetary policy must support what it calls a redistributive agenda that will support housing and developmental infrastructure finance through differential interest rates.
- Industrial development must be based on local procurement to build a cohesive industrial base for the country. This, it says, will create decent work, increase the sustainability of the economy and deepen the tax base.
- It seeks to have collective and public forms of ownership, claiming that the black population has suffered under the history of dispossession caused by apartheid. It says the mines, steel production and the petro-chemicals industries should be in the hands of the state. Moreover, co-operatives should be supported to create alliances in ownership of the economy and contributing to the redistribution of economic power while breaking the stranglehold that a few conglomerates exercise on the economy.
- It says that the southern African region must be developed as a whole, as one country cannot tackle all the challenges facing the region. It advocates a sustainable regional approach based on building regional economic capabilities, technology transfers and regional economic development for the sub-continent. There must be, what it calls, the political will to industrialise the region and link national industrial initiatives into a regional industrialisation strategy.
- It says that economic growth and development must support sustainable environments and minimise the disruption of natural processes, degradation, soil erosion, desertification and pollution of the water streams and groundwater resources.

The Cosatu document goes on to highlight its primary objectives as providing:

- An outlook that is biased to the working classes, is based on participatory democracy and is anti-imperialist;
- Decisive intervention by the state in the economy to redistribute resources;
- Direct responsibility for its own role and relying less on the private sector and market forces by nationalising strategic sectors, promoting co-operative ventures and work-centred forms of ownership and promoting regional integration.
- Universal access to decent jobs, quality education and healthcare, comprehensive social security, decent housing and access to water, sanitation and energy.

It says the state has moved away from directly delivering basic goods such as housing, social infrastructure, schools, hospitals and roads and has become an administrator of tenders, a collector of taxes, a national fundraiser through public borrowing and a disburser of funds. It wants the government to now deliver social and economic infrastructure and, in that way, create more jobs. To do this, says Cosatu, the government must:

- Develop its extractive capacity by mobilising national savings for development, have a quantitative regulation of credit allocation and introduce a progressive tax and levy system.
- Must increase its redistributive capac-

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WATTnow, published monthly by Crown Publications and the South African Institute of Electrical Engineers, provides a fascinating insight into:

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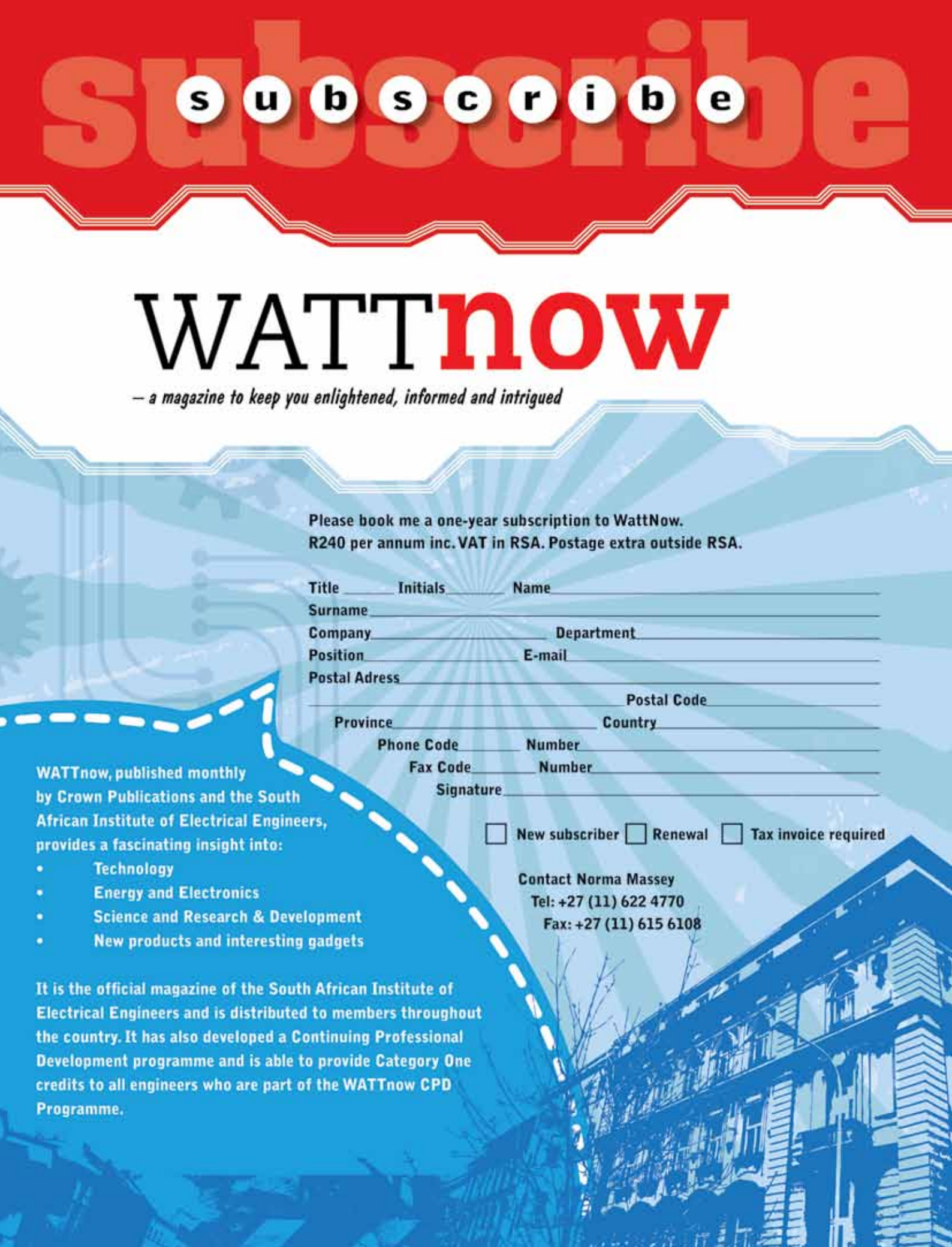

ity by improving and expanding its provision and access to basic goods and services for the working classes and the poor communities and increase its social security provisions.

- It must provide employment guarantees for all those willing and able to work for a statutory minimum wage in the public sector to roll out basic goods and services.
- Introduce a low interest rate policy to redistribute social surpluses through development finance institutions and a State Bank.
- Promote collective forms of ownership of small and medium enterprises through providing credit, access to capital, equipment, technology and skills.
- Introduce a tax on financial transactions to re-orient investment towards the productive sectors.
- Increase its transformative capacity by providing materials such as steel, chemicals, fertilisers and capital equipment to target sectors at affordable prices, increase labour intensity for all state-owned enterprises and support research and development for new technologies and products to meet basic needs.
- It must also develop an innovation system linked to state entities in education and training and set aggressive targets and punitive measures to promote social transformation.
- Cosatu wants to remove the profit motive from the provision of basic goods and services.
- It has also called on the state to increase its administrative capacity using a highly-skilled cadre to drive the state apparatus and the economy. It says this must be coupled with an aggressive programme for human resource development among all public servants including those in state-owned enterprises.
- It wants the government to reduce the pay gap between private and public sectors through putting controls on private sector pay levels and bonuses.

It has accused the government of creating, over the past 16 years, a developmental state for black and white capitalist accumulation that has resulted in a complex of crises including energy, water, unemployment, education and health.

In terms of rural development, Cosatu says that there are three pillars in the government's policies. These are land reform, agrarian transformation and rural development. However, it is opposed to the government's goal of relinquishing state-owned land as part of the land redistribution process particularly if racial, gender and class concentration of ownership of land persists. Instead it wants the land to be allocated to co-operatives and it wants government to develop a policy to deal with expropriation of unused or unproductive land such as that used for game-farming, golf-estates or land held for speculative purposes. It also wants to regulate foreign ownership of land and encourage foreign investment in the agricultural sector.

It has urged the state to support sub-sectors that produce machinery and equipment for use in the agricultural and food processing sectors and to introduce restrictions on the export of raw agricultural produce.

In rural areas it wants to see a revitalisation of skills development through colleges and sector education and training associations, improve health facilities for rural people, an extension of banking services through Post Bank branches and an improvement of the transportation infrastructure in the rural areas. It also wants government to improve information technology infrastructure for rural enterprises, schools, households and health facilities.

It has called on government to insist that Transnet revitalise the rail system, Eskom to extend electrification programmes, Telkom to roll out telecommunications infrastructure and the Post Office to provide rural banking services. It also wants the nationwide irrigation scheme to be revamped and for the state to own food processing, procurement and distribution enterprises across the food chain in order to "democratise" food production and increase access to market by co-operatives and small-scale farmers.

It supports the formation of a Rural Development Agency and a Rural Regulatory Authority to regulate food and other agricultural prices and exports. It wants government to stabilise food prices by releasing state-held stocks to counter fluctuations in food prices when stocks rise or fall.

Cosatu wants to restrict the speculative activity in the financial markets relating to food and commodity prices through a tax on financial transactions. In summarising its findings, Cosatu says that the new growth path for South Africa must comprise:

- The creation of decent work for people;
- A redistribution of income and power;
- Greater industrial development;
- Provision of basic infrastructure to meet basic needs;
- Environmental sustainability for the country;
- The development of the southern Africa region.

Its economic policy is based on rural development, strict industrial development and trade policies and skills development while its social policy focuses on education and healthcare, reducing crime and corruption and improving the justice system.

It has called for changes in the patterns of ownership and redistribution of wealth along with extensive regional development initiatives.

It emphasises, though, that the policy proposals in its document should be seen as a package of interventions and not as individual aspects. For example, fiscal and monetary policies must be linked to employment creation.

Much of what Cosatu has outlined in it's Growth Path Towards Full Employment is certainly laudable particularly in terms of education, healthcare, greater research and development and higher levels of government efficiency.

Like any brainstorming session, or pipe dream, the acid test is in the practicality of its suggestions and to suggest widespread nationalisation of mines, petrochemicals and steel on one hand or the development of a major agricultural machinery manufacturing sector on the other seem beyond the bounds of realism.

But that might purely be a cynical view from a sceptic who has heard so many of these good ideas before and who has seen them die a stillborn's death before a decade has ended.

It has been said before, by many wiser people than me, that the devil is in the detail. And while there are some lovely ideas in this document, that's all they are really. Ideas.

Helium will run out because the world's biggest capitalist doesn't believe in free trade

By Gavin Chait

Professor Robert Richardson shared the 1996 Nobel Prize in Physics for his 1972 discovery of the property of superfluidity in helium-3 atoms. And he is a worried man. "There is no chemical means to make helium. The supplies we have on Earth come from radioactive alpha decay in rocks. Right now it's not commercially viable to recover helium from the air ... but if we do run out altogether, we will have to recover helium from the air and it will cost 10 000 times what it does today," he says in New Scientist.

Helium isn't just useful for turning your voice squeaky and amusing children at parties. 22% of the annual total world production of 32 million kilograms goes into cooling the superconducting magnets in MRI scanners. 78% is used to pressurise and purge pipelines, in the maintenance of controlled atmospheres, and in welding.

Helium diffuses through solids at three times the rate of air and so it is used as a tracer gas to detect leaks in high-vacuum equipment and high-pressure containers. The Large Hadron Collider at CERN uses 96 metric tons of liquid helium to maintain its operating temperature of 1.9 Kelvin.

It's quite important stuff. And, in 25 years, we'll run out.

In 1925 the US government set up the National Helium Reserve outside Amarillo, Texas. US natural gas fields have an unusually high concentration of helium, which makes it the most productive place for extraction. By 1995 the government had over one billion cubic metres of gas and had incurred a debt of $1.4 billion for its collection and maintenance.

The easiest thing to do would have been to increase the price of helium to cover these costs. Instead the US introduced the "Helium Privatization Act of 1996". That sounds noble but it ain't. What it involves is the US selling off all its remaining helium at bargain-basement prices and then scrapping the remaining plant. This wouldn't be too dramatic if the US didn't also produce 80% of the global helium supply. What America is doing by accident the Chinese are doing on purpose. Japan and China came close to an outright trade war this year after China banned rare earth exports following the arrest of a Chinese fisherman for infringing on Japanese territorial waters. For the first time manufacturers are recognising the danger of Chinese control of 97 percent of all rare earth accessible reserves.

Rare earth metals are a collection of seventeen chemical elements in the periodic table, namely scandium, yttrium, and the fifteen lanthanides. Rare earth elements are now incorporated into many technological devices, including superconductors, samarium-cobalt and neodymium-iron-boron high-flux rare-earth magnets, magnesium alloys, electronic polishers, refining catalysts and hybrid car components. The first casualties of rare earth scarcity could be touch screens on mobile phones.

In several years, worldwide demand for rare earth elements is expected to exceed supply by 40 000 tonnes annually unless major new sources are developed. China is leveraging its control to demand that companies wanting access to supply must locate their factories in China.

This can only be a short-term tactic as the sudden rise in prices is sparking a dramatic deluge of investment into exploration and development of existing mines. Some of the bigger American mines, particularly in California, closed as a result of Chinese investment which lowered costs, as well as American health and safety legislation. These can all be overcome as the price rises. It's the easiest thing in the world to allow prices to rise in response to market scarcity. Female chimpanzees will mate with males who give them the most fruit. In response, males steal desirable treats, such as papaya, from farms in order to woo coveted females. Human beings even get in on the act given a paucity of desirable goods.

A 100 kilometre traffic jam into Beijing in September left thousands of drivers stranded. Ever helpful, local traders rocketed up prices for noodles, boxed lunches and snacks as they wended their way through the idle vehicles. One trucker contemplated his meal with evident disgust, "Instant noodles are sold at four times the original price while I wait."

In Niger, Save the Children is complaining that traders are hoarding scarce grain. "These traders are using market fluctuations to make a profit at the expense of ordinary people," says Josh Leighton, food security and livelihoods officer at Save the Children. Yes, Josh, they are. The famine is not the result

of the speculators. The speculators are ensuring that a scarce resource does not run out and goes to those who value it the most. Selling food for less than it costs means that, like helium, you will soon have nothing. Higher prices are a signal and you should be listening, not whining.

Which would you prefer: cheap party balloons for a few more years, or MRI scanners in hospitals?

Magnetic Resonance Imaging is a relatively new technology, having been launched on human patients only in 1977. Unlike CT scans or X-rays MRI uses no ionizing radiation. In other words it is significantly safer to use. A powerful magnetic field aligns the magnetisation of some atoms in the body, and then radio frequency fields systematically alter the alignment of this magnetisation. The nuclei then produce a rotating magnetic field detectable by the scanner and transcoded to construct a detailed view of the body.

These powerful magnetic fields are achieved only when the electromagnet achieves superconductivity. That is ensured by relying on cryogenic liquids to keep the conductor sufficiently chilled. That cryogenic agent is helium.

Just how important are MRIs? The alternative to MRI in identifying cancerous tumours is the CT scanner which uses ionising X-rays. The amount of radiation exposure in CTs is extremely large and quite dangerous for those already undergoing chemotherapy. The benefit of MRI is that it can be used repeatedly without harm to either the patient or the operator. MRI can also generate cross-sectional images in any plane.

Yet MRIs are not cheap. A basic 1.5 tesla scanner starts at $1 million and 3.0 tesla scanners go up to around $2.3 million. That's before factoring the cost of the physical building – at $500,000 – to house the unit, and the skilled staff to operate it. Despite these costs MRI is being used in a range of therapies and scientific fields.

Interventional MRI allows surgeons to perform minimally-invasive procedures on patients; looking into the body but without resorting to traumatic and physically damaging surgery. Radiation therapy simulation permits tumours to be specifically targeted. The MRI system calculates the precise location, shape and orientation of the tumour and then marks points on the patient which allow accurate triangulation for radiation therapy. This improves the chances of removing the tumour as well as massively reducing overall radiation exposure.

Outside of medicine, biologists and psychologists are exploring the seat of consciousness and decision-making by accurately observing neural behaviour within the brain. Some of this technology is going into develop mind-machine interfaces to allow thought-based control of computers. This would be particularly useful for paralysed individuals. Portable versions of MRIs are being developed to allow this to happen.

Professor Christof Koch, Professor of Biology and Engineering at the California Institute of Technology in Southern California spoke at this year's Charles Simonyi Lecture, the annual lecture for the public understanding of science. He discussed how his research is closing in on the fundamental elements of consciousness. He has explained his purpose as being, "To understand how consciousness is linked to the brain, how the flickering activity of myriad nerve cells leads to ineffable experiences, of seeing blue, of being warmed by the sun, or of being scared by exposure on a climb." He uses MRI to monitor the behaviour of individual neurons the brains of his subjects.

These procedures and uses just aren't feasible with CT given the immense radiation that users are exposed to during their use. So, even though CT is cheaper, its use is being limited only to those procedures where MRI is less accurate or where patients need to be diagnosed just once.

MRIs are becoming critical both to research and innovation in therapy and computing. Prices will come down as the technology becomes mature but the industry is dependent on what – to date – has been a readily available cryogenic compound.

The price mechanism is probably the greatest invention of human history. How else do you think innovation happens if not through the spur of rising prices and profits?

It is not through the benevolence of Apple, Facebook, or Amazon that we get our slick new iPad, free social media platform, or exciting new ereader, but to these companies' obsession with their continuing profitability. Just as China's heavy-handed limiting of rare earths has driven up prices and spurred pursuit of alternative supplies, America's refusal to allow helium prices to rise is denying investors the opportunity to seek alternatives. Why not do it anyway? Because no company can long supply a product if a significantly cheaper identical alternative is available. For alternative supplies of helium to come available the price must rise, just as for alternative energy to become available the cost of oil must rise.

The surprising thing is that the US, a nation supposedly a capitalist "red in tooth and claw", is so bereft of comprehension of these factors when it comes to their helium supplies. But then, with subsidies to farmers, motor manufacturers and other favoured industries, the Americans aren't really capitalists, are they?

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EU petition to prevent modified crops

More than a million people have signed a petition aimed at preventing the European Union from approving any new genetically modified crops. The campaign was organised by Greenpeace.

The petition calls for the European Commission to stop approving any genetically modified crops and to set up a new scientific body to study the impact of the genetically modified organisms on the population.

In March this year the European Commission approved cultivation of the Amflora potato.

Greenpeace's European Union director Jorgo Riss says that over a million people in Europe have now set the EU a democratic test demanding that it addressed the real concerns that people have with consuming genetically modified crops.

He claims that until independent scientists have scientifically evaluated safety issues of these crops, all authorisations should stop.

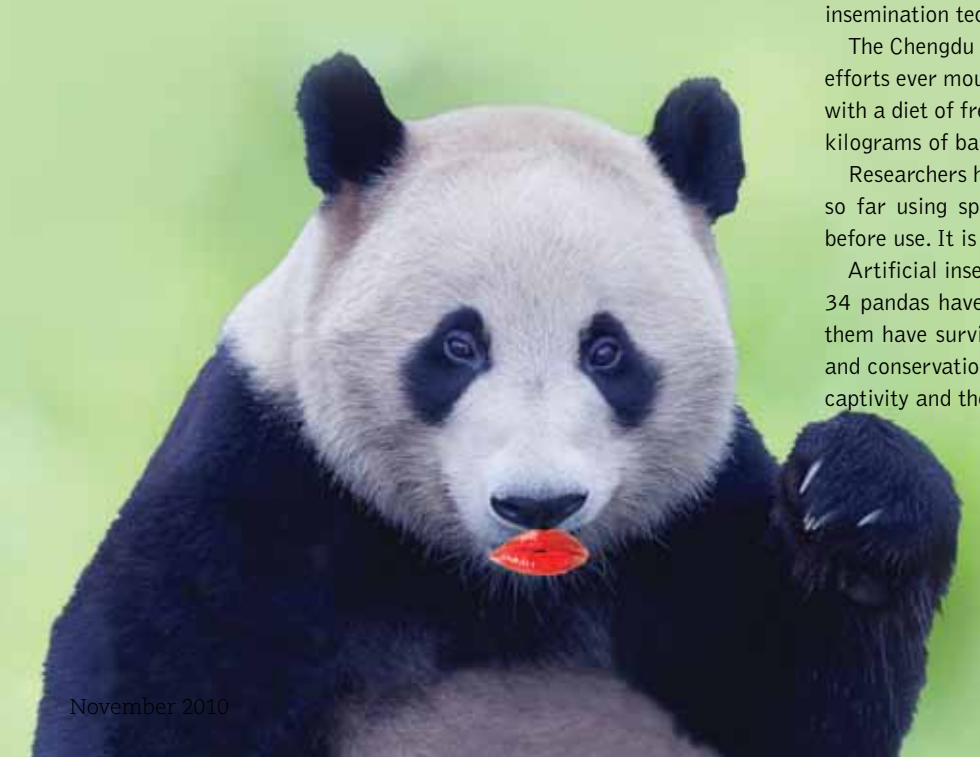
John Dalli, the EU commissioner responsible for the organisation's policy on genetically modified crops has agreed to take the petition seriously. The commission has three months in which to decide what action to take now that it has received the petition.

Earlier this year the Commission proposed that the rules re government cultivation of genetically modified crops should be changed to allow individual governments to decide whether or not to approve them.

Viagra and porn may stimulate pandas?

A controversial project in China aimed at encouraging pandas to breed uses a combination of Viagra and pornographic material in an attempt to boost sexual activity in these animals.

The Chengdu Research Base is attempting to breed a stable population of 300 pandas and then set them free in the wild.



Female pandas are on heat for less than 72 hours a year and even the use of Viagra and videos of pandas mating do not often achieve the desired results.

There have been many futile attempts by researchers to get young pandas to mate and most of the cubs have been born after artificial insemination techniques were used.

The Chengdu Research Base is one of the most costly conservation efforts ever mounted by the Chinese authorities and provides pandas with a diet of fresh bamboo every day. An adult panda eats about 20 kilograms of bamboo each day.

Researchers have successfully managed to produce one panda cub so far using sperm that had been taken from a male and frozen before use. It is the first successful pregnancy using frozen sperm.

Artificial insemination is commonly used for breeding pandas and 34 pandas have been born as a result of this technique and 30 of them have survived. There are only 1 600 pandas living in the wild and conservationists are keen to boost numbers by breeding them in captivity and then returning them to the wild.

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Mobile subscriptions keep rising fast

There could be as many as 265-million broadband Internet subscriptions in Africa by 2015, up from the estimated 12-million users at the moment, claims research firm Informa Telecoms & Media.

It says that overall African mobile subscriptions are expected to grow to 842-million over the next five years, up from the 506-million subscriptions that exist at the moment. The increase is expected to be driven by strong growth in Ethiopia, the Democratic Republic of Congo, Eritrea and Madagascar.

It estimates that the continent currently accounts for about 10 percent of the world's mobile subscriptions and remains one of the fastest-growing regions in the world with mobile phone subscriptions rising by 18 percent since the beginning of this year.

Senior analyst at Informa, Tecla Mbongue says that mobile money services are expected to attract 360-million users over the next four years.

Once new undersea cables are connected and fully operational there will be significant new growth opportunities for service providers particularly when it comes to data services.

"The lack of a terrestrial-based backbone could lead to bottlenecks in delivery of services to inland or more remote regions," says Mbongue.

In a separate development, South African Internet Service Provider, MWeb has been voted ISP of the Year, Mobile provider Cell C won the Mobile Broadband Service of the Year and Telkom won the Fixed Broadband Service of the Year. Vodacom was the Broadband Provider of the Year.

The Independent Communications Authority of South Africa was awarded the undignified accolade of the Mampara of the Year for holding back progress in the local market.

Who wants a diamond the size of Table Mountain?

A planet with ultra-high concentrations of carbon has been discovered by a team of British astronomers and their discovery supports the idea that there may be carbon-rich, rocky planets that are made up of diamonds or graphite.

According to Dr Marek Kukula of the Royal Greenwich Observatory there could be entire land masses and even mountains made up of diamonds. The work has been described as an astonishing astronomical tour de force.

The planet was detected using the Spitzer Space Telescope and thermal radiation. It is about 1 200 light years away. Kukula says the planet is a thousand times fainter than the star it orbits.

He says the scientists had to perform an amazing feat of precision measurement to extract the information about the composition of this particular planet. Astronomers have discovered about 500 exoplanets so far.

The new planet, known as Wasp 12b is the first planet found that has more carbon than oxygen in its atmosphere. It is a gas giant like Jupiter and is mostly made up of hydrogen gas.

However, the planet's core is composed of some form of diamond, graphite or carbon compound, possibly in liquid form.

The study says that there may be many Earth-sized planets that are ultra-rich in carbon but these worlds would be unlike anything seen before.

Kukula says that these planets lack water so if the temperature was sufficiently high, liquid on the surface would consist of carbon-rich compounds such as tar.

Scientists don't know why the level of carbon is so much higher on Wasp 12b but the theory is that plenty of water-ice was available when the planets formed and this might have been the cause.

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Arsenic used as fundamental building block

The deadly poison, arsenic, is used as a building block for biological molecules such as those in DNA. Scientists say that the discovery that arsenic is used by bacterium as a substitute for phosphorous as it shares similar properties.

Arsenic has been added to the list of six elements involved in the chemistry of life. The others are oxygen, carbon, hydrogen, nitrogen, phosphorous and sulphur. It had been assumed by scientists that for life to exist it had to contain these same six elements as the fundamental building blocks of biological molecules.

An arsenic-using microbe known only by its code name GFAJ-1 was extracted from muddy sediment in California's Mono Lake, which is naturally salty and has high concentrations of arsenic in its waters.

Tests have demonstrated that the bacterium actually grows better when it is exposed to phosphorous but it appears to be quite ready to use high concentrations of arsenic in the absence of phosphorous.

The study reports that arsenic in the form of arsenate can make the appropriate chemical bonds with carbon and oxygen to act as a substitute for the phosphate molecule normally found in DNA and other biological molecules.

Sophisticated analytical techniques have shown that the arsenic was incorporated into the proteins, lipids, nucleic acids and other vital molecules found inside living cells.

The discovery has vindicated a theory put forward by Dr Felisa Wolf-Simon of the Nasa Astrobiology Institute in 2006, which suggested that primitive life forms on Earth may have used arsenic as building block. She suggests that similar microbes may still exist in some extreme environments on Earth.

She says that the findings show that the requirements for life could be much more flexible than had been assumed in the past.

Anti-hydrogen atom found at CERN

European scientists have been able to capture anti-hydrogen atoms in a novel magnetic trap and they might now be on track to unlock the mysteries of anti-matter that have puzzled scientists for a long time.

Anti-matter is a subject of intense speculation in the global scientific community because it has been cited as a potential source of boundless and almost cost-free energy.

CERN, the European Organisation for Nuclear Research made the announcement just a few weeks after another group working on the same problem said that they had made and caught elusive anti-matter atoms for the first time.

Yasunori Yamazaki, a member of the team that trapped the anti-hydrogen atom says that anti-matter will not be able to hide from researchers for much longer.

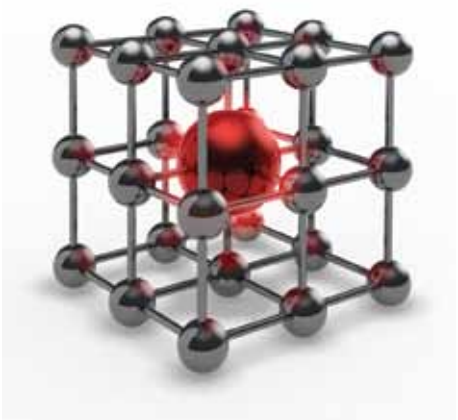
It is believed that anti-matter was created in the same quantities as conventional matter when the Big Bang occurred about 13,7-billion years ago.

In a separate announcement, CERN has announced that it will be closing down its Large Hadron Collider for two months after it has had an unbroken stint of eight months of scientific research.

CERN's director-general, Rolf Geuer, says that the scientific discoveries have been rolling in so fast that the LHC's operation will be stretched to at least 2012, a year longer than originally planned.

Apparently it was in the LHC that 38 anti-hydrogen atoms were captured in flight and held for a fleeting moment so that initial observations of their properties could be made.

New equipment developed by Asacusa, Alpha and Atrap overcame the problems that had prevented the close study of anti-particles.



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JOJEN SUPPLIES

Will achieving the UN Millennium Development Goals create economic self-sufficiency?

By Gavin Chait

A neat trick - if you're a bored electrical engineering student - is to rig up an oscilloscope as a rough-'n-ready electrocardiography device. Then you can while away time at afternoon practicals watching your heart beat and concentrating on lowering or raising your pulse rate.

What you can measure and visualise you can influence.

With only five years left to achieve the UN's Millennium Development Goals, world leaders swooped into New York for a major conference from 20 to 22 September. At its heart is the question: will the laudable goal of halving global poverty by 2015 be achieved?

The UN is already preparing the ground for failure and identifying the scapegoats.

"Despite aid flows at an all-time high of $120 billion in 2009, among the most urgent areas identified in the report is a current shortfall of about $20 billion in the annual level of aid as agreed five years ago by the Group of Eight."

The UN believes that tackling poverty will not be possible until the wealthiest nations get their act together. Some scholars agree.

Professor Hans Rosling, of the Karolinska Institute in Sweden, has an engaging way with beautifully-rendered charts and demonstrates them at trendy conferences like the TED Talks. From Rosling one can watch, in full colour, as increased aid leads to increased life-expectancy.

However, correlation is easy to manufacture. You could plot refrigerator sales on life-expectancy and come to the conclusion that giving these away would yield similar improvement.

Life-expectancy changes slowly whereas cash transfers are easier to measure. Could it be that rising wealth leads people to buy refrigerators and make other improvements to their welfare, thus resulting in an increased lifespan?

Even with the most generous spirit it is hard to see how any amount of charity would assist bug-fests like Zimbabwe, Somalia, Burma or North Korea in halving poverty.

Countries with some of the highest proportions of aid tend to have the least to show for it. Africa has received $43.9 billion in direct aid from the members of the G8, 36% of total overseas development aid.

However, China has loaned some $14 billion to African nations in order to build infrastructure to support extractive industries. Is the sudden economic growth spurt in Africa a result of aid, financing schools and clinics, or of Chinese-financed mines, roads and harbours exporting commodities?

Despite the UN's fears, halving world poverty is likely to be met because India and China are both on track to surpass their objectives. China receives some $1.49 billion a year in development aid, less than 0.03% of its GDP. India receives $2.11 billion, less than 0.2% of GDP. The countries with 33% of the world's population receive just 3% of its charitable aid.

"Over the past few decades, China has managed to move hundreds of millions of its people out of poverty by combining state intervention with economic incentives to attract private investment -- the kind of experimentation that the Chinese leader Deng Xiaoping once described as 'crossing the river by feeling the stones,'" writes Deborah Brautigam in Foreign Affairs. Now China is exporting this model of state-led investment into Africa.

It certainly isn't true that state-intervention is a cure-all. It only works for China because of their large current account surplus, but charity doesn't appear to be the qualifying factor in economic development for a number of reasons.

Firstly, poverty is relative. In the UK a report points to a trend that means government is failing to achieve the reduction of child poverty. The indicators? Children in the UK are getting less pocket-money and going on fewer vacations.

Secondly, by definition, charity has to come from those who are wealthy to those who are poor. A reliance on such donations is going to perpetuate income inequality. Only those who can generate wealth for themselves can break their dependency and continuing social inequality.

If anything, there appears to be an inverse correlation. The more aid a country or region receives the worse it performs over time.

"Clumsy attempts to do good end up harming communities we want to help. We have seen it with foreign aid, corrosive in so many countries by propping up despots, fostering corruption and destroying local enterprises. We have seen it with the dumping of cheap food and clothes, devastating industries and encouraging a dependency culture. And now we see it with 'voluntourism', the fastest-growing sector of one of the fastest-growing industries on the planet," writes Ian Birrell in a scathing column in the London-based Observer.

Such economic demand for opportunities is creating a perverse market for the supply of squalor. A government study in Ghana found up to 90% of the estimated 4 500 children in orphanages in Ac-

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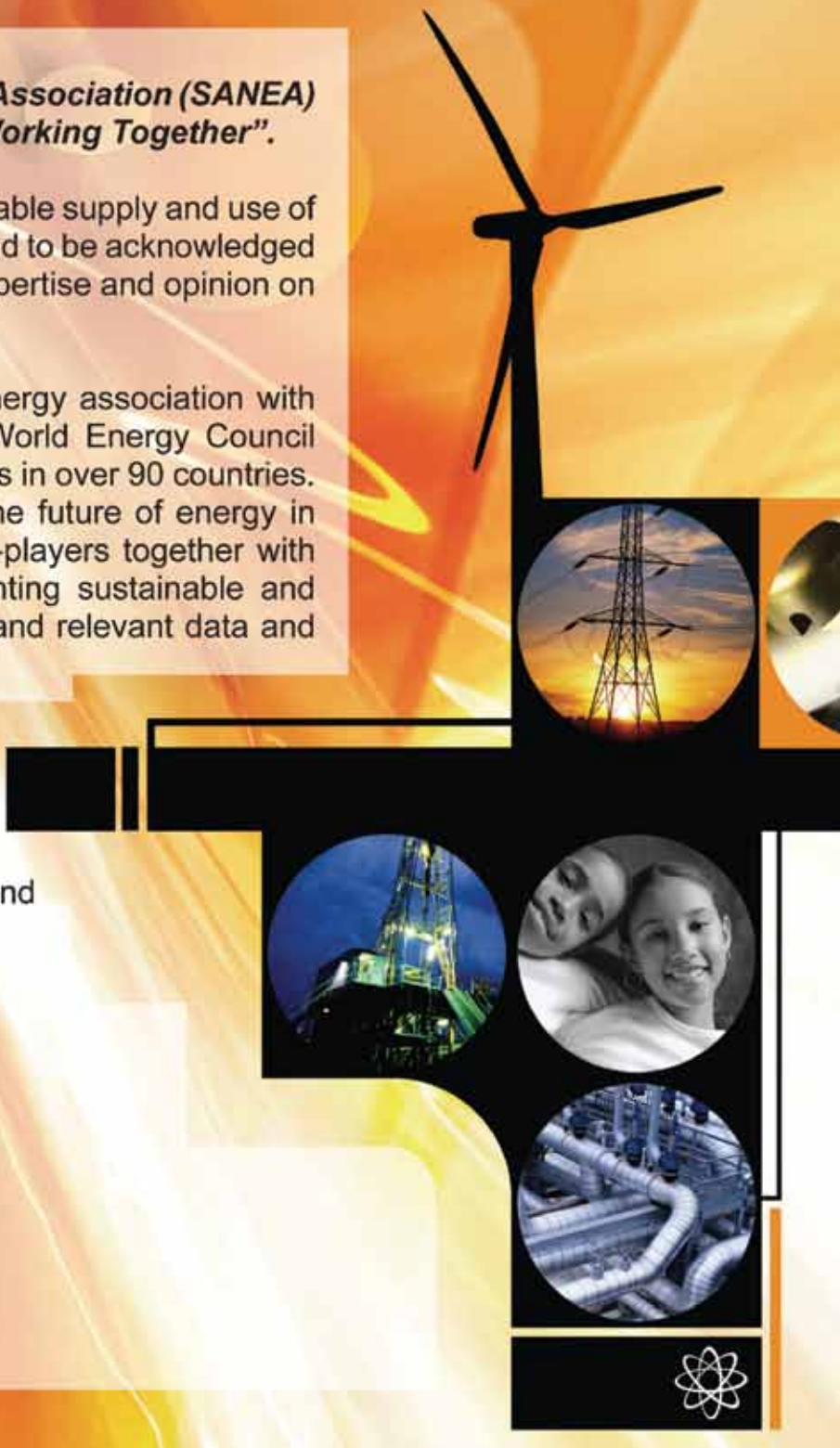

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cra had at least one parent and only eight of the 148 orphanages were licensed.

Professor Linda Richter produced a report for the HSRC in South Africa entitled 'AIDS orphan tourism: A threat to young children in residential care'. "Short-term volunteer tourists are encouraged to 'make intimate connections' with previously neglected, abused, and abandoned young children. However, shortly after these 'connections' have been made, tourists leave - many undoubtedly feeling that they have made a positive contribution to the plight of very vulnerable children. And, in turn, feeling very special as a result of receiving a needy child's affection.

Unfortunately, many of the children they leave behind have experienced another abandonment to the detriment of their short- and long-term emotional and social development," she says.

What Professor Richter fears is that orphans are becoming just another tourism commodity, like nature reserves and beaches. If poverty is a 'valuable' income generator then more poverty is what aid and charity will buy.

The thing about economic incentives is that one cannot duck their consequences. If more money is available for a particular end then you'll get more supply; whether that be illicit drugs, or orphans.

William Easterly, Professor of Economics at New York University and author of 'The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good,' has said, "I think the viable arguments are that (1) aid's record is sufficiently disappointing that it is unlikely to ever be the main driver of successful development, (2) if aid were more accountable it would do less ill and more good."

In fact there seems to be a growing backlash against aid in the mainstream press even as major environmental disasters have struck Haiti, Pakistan and Indonesia in the past year.

"Don't be so gloomy. After all it's not that awful. Like the fella says, in Italy for 30 years under the Borgias they had warfare, terror, murder, and bloodshed, but they produced Michelangelo, Leonardo da Vinci, and the Renaissance.

In Switzerland they had brotherly love - they had 500 years of democracy and peace, and what did that produce? The cuckoo clock," says Harry Lime, in The Third Man.

Part of the problem is that once a country has missed the latest economic wave it has to wait until it can find a new one. Asia and Africa, coming out of the Second World War, were equally positioned to become the world's workshops. In 1957 South Korea had a lower per capita GDP than Ghana, and by 2008 it was 17 times as high as Ghana's.

Amongst all this confusion of definitions and correlation is one very important achievement. There is now an ever-growing database of economic and social data for just about every country in the world.

Just the reality of this data is resulting in improvement as different governments prioritise different criteria in order to deliver change. The data is monitored by so many third-parties that, unlike ballot-stuffing, governments can do little to lie about their own indicators.

One of the most successful is the World Bank's annual Ease of Doing Business Index. Governments are competing to see who can offer the best business environment. Since every country (including the ones at the top) is trying to do better, simply standing still will result in a relative decline.

"As with other indices issued of late, South Africa has not lost place as a result of declining scores, but rather as a result of other economies improving at a more rapid rate," says Brand South Africa CEO, Miller Matola.

"Our consistent ratings are underpinned by improvements in areas such as closing a business, where we are up three places to 74; as well as in enforcing contracts where we improved on position to 85, from 86. In contrast to this, South Africa lost ground in areas such as starting a business, registering a company and trading across borders," says Matola.

But a positive spin on a bad result isn't going to attract the investors. South Africa will have to either do something about improving, or watch real investment go elsewhere. Like tiny Mauritius which has set the very ambitious target of reaching the top 10. They currently rank 20th and are well on track to achieving their target. South Africa has fallen two spots to 34.

Measurement is doing far more to alleviate poverty than any amount of good will, global summits, or charity.

Along the way we will have the chance to definitively qualify whether aid achieves its objectives. We can start looking for the real indicators of economic growth. Then, maybe, we can use aid to create appropriate economic incentives.

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Petrol engine smaller than a finger-tip

Scientists at the University of Birmingham have apparently built a petrol engine that is so small it can fit onto a finger-tip and can run for more than two years on a single squirt of lighter fuel. It produces 700 times more energy than a conventional battery.

Lead engineer, Dr Kyle Jiang at the University of Birmingham's mechanical engineering department says that the new engine is a breakthrough for devices that need to be re-charged because, within the next six years, batteries will no longer be the primary source of power for these electronic devices.

One of the main problems that engineers faced is that these micro-motors produced a lot of heat and got so hot that they burned themselves out and could not be reused. However, the engineers have apparently overcome this problem by using heat-resistant materials such as ceramics and silicon carbide.

Professor Graham Davies, head of the university's engineering school, said that the researchers brought all the engineering disciplines together to create what he claims is a second industrial revolution in nano-technology.

He says that a battery uses 2000 units of energy to create a charge that is sufficient to deliver a single unit of energy, whereas this tiny petrol motor uses a fraction of that to deliver a sustained energy output.

The motors can be used in a number of computer applications but could also be ideal for pacemakers and other medical devices, many different military uses and a number of new applications where, in the past, batteries have been the source of energy.

The motor is less than a centimetre long.

Private project to carry goods into space

A privately funded craft to carry cargo into space is making its first test flight – into space at an orbit of 300 kilometres – and, having carried out a number of manoeuvres, will splash down in the Pacific.

The SpaceX Dragon will be launched from Florida on the back of a Falcon 9 rocket. SpaceX has a budget of $1,6-billion contract with the National Aeronautics and Space Administration to provide 12 spacecraft with a carrying capacity of 20 tons to resupply the international space station between 2011 and 2016.

The test is the first of a series of tests to prove that SpaceX's systems work as planned. The Dragon capsule will not be allowed to venture anywhere near the space station until it has proven that it is safe to use.

SpaceX president, Gwynne Shotwell says that the Falcon 9 has performed well but there are many difficulties that lie ahead before the project can go into operation.

Having taken off from Cape Canaveral, the Falcon 9 will head for an orbit that is inclined 34,5 degrees from the equator. The Dragon capsule will separate from the rocket launcher after just nine minutes and 35 seconds. The capsule will then complete two orbits of the Earth while its on-board systems will be tested and demonstrated. The return will see Dragon re-enter the Earth's atmosphere and then three parachutes will be used to control the descent into ocean water roughly 800 kilometres off the coast of Mexico. So far SpaceX has completed 17 milestones set down by Nasa and has been paid $253-million. If it completes the next series of 22 milestones a further $278-million will be paid to the organisation.

SpaceX says that it has spent more than $600-million on the Falcon and Dragon project so far.

More than gold at AngloGold Ashanti

AngloGold Ashanti has won the 2010 Excellence Award from the South African Association for Energy Efficiency for the outstanding contribution it has made in conserving energy and alleviating some of the pressure on the national electricity grid.

Between 2005 and 2008 the company managed to save more than 1 000 GWh, resulting in cash savings of more than R180-million.

The company has, since the beginning of last year, implemented further energy efficiency measures that will save 23 MW of electricity, and other projects that could add seven megawatts to this are currently being investigated.

It has replaced all its incandescent lights used in mines with compact fluorescent lighting bulbs. The fluorescent light fittings have had ballast replaced with electronically controlled ones.

Then, the mining company has optimised the use of its motors, drives, pumping systems, valves and winders and has introduced heating, ventilation and air-conditioning systems that are energy efficient.

The award was presented to AngloGold Ashanti at the annual banquet of the SAEE held at Emperor's Palace in November.

Eskom funding now R440-billion

Eskom says it has secured R440-billion to ensure that its new build programme goes ahead.

Brian Dames, the utility's chairman says that the power supply will be tight for the next five years and particularly so next year but as soon as the new power stations come on stream then South Africa's power supplies will stabilise.

He concedes that Eskom currently has a monopoly over power supply in South Africa but he reckons that this will change soon when new independent power producers enter the power generation business.

Meanwhile, an attorney at Werksmans Attorneys, Happy Masondo says that Eskom will not resolve South Africa's power problems simply by letting go of the power it has as a monopoly in the power supply sector.

"Eskom is fully aware of its inability to produce sufficient power to avoid rolling blackouts and the Medium Term Risk Mitigation project team has been set up to reduce the threat of these blackouts," he says.

Eskom currently has a maximum capacity of 41 000 MW while the country consumes about 37 000, leaving a reserve margin of about 10 percent, which is about half of what is accepted as an international benchmark.

Masondo says that it is in the country's interest to let the IPPs produce electricity and sell it to consumers directly rather than going through Eskom.

Meanwhile Dames told a press conference that new energy plans – that will include IPPs – are currently under discussion with the Department of Energy, the Department of Public Enterprises and other government bodies.

The funding for the current build programme comes from R160-billion raised from debt capital markets, R100-billion from development finance institutions and export credit agencies, R40-billion from government, comprising R20-billion of the original R60-billion and a proposed additional equity injection of another R20-billion.

Eskom says that a large amount of the current construction work has been completed. The utility released six-monthly results to September and says that its net profit for the period rose to R9,5-billion compared with just R1,1-billion for the same period last year.

Revenue increased to R51,1-billion, up from R38,2-billion for the same period last year.

According to Dames, Eskom has signed contracts with several IPPs to avoid rolling blackouts next year. It is apparently ready to sign agreements for 1 000 MW of power from independent producers and will generate a further 1 000 MW from gas turbines as required.

Meanwhile the new Public Enterprise Minister, Malusi Gigaba has confirmed that the government will continue to support Eskom to ensure that it kept the country's lights on, but warned that the next two years will be very tight for the utility.

Hybrids, electric cars tested

The Environmental Protection Agency in the United States estimates that Nissan's new Leaf battery-powered vehicle uses just 2,4 litres of petrol per hundred kilometres and that its range is just 117,5 kilometres, considerably less than Nissan's official estimate of 160 km.

According to Nissan, the annual electricity cost for charging the Leaf's batteries is just $561. However, the company's director of advanced technology strategy, Mark Perry, says that the driver's behaviour and the outside ambient temperature both affect the range of these vehicles.

The EPA's estimate of 2,74 litres per 100 kilometres is almost half that of the Toyota Prius with a fuel economy rating of 4,28 litres per 100 kilometres. The EPA used 33,7 kilowatt hours as being equivalent to a gallon of petrol and its figures suggest that the Leaf will provide fuel economy of 99 miles per gallon.

Perry says the company is happy with the conversion rate applied by the EPA. To calculate the annual running costs, a figure of 12 US cents per kilowatt hour was used but Perry pointed out that these costs vary considerably from one state to the next.

The vehicle will need about seven hours to charge, using a 240 V socket and consuming 34 kilowatt hours for every 100 miles travelled. It received the best scores among the hybrid or electric cars tested for emissions of greenhouse gases or any other pollutants.

The EPA tested the Toyota Prius and Chevrolet's Malibu but has not yet tested the new Chevrolet Volt, a plug-in hybrid that has a petrol engine that allows the car to be used when the battery is flat. The Volt has a range of about 80 kilometres running on electric power.

Exxaro's wind power ready by 2012?

The first wind power from the Brand-se-Baai wind generation project on South Africa's west coast will be fed into the grid by the middle of 2012 claims Chikoma Kazunga, energy growth division business developer at Exxaro Resources.

The project is currently in a pre-feasibility stage and the company has started its environmental impact assessment. A wind mast that is 80-metres high has already been erected on site to measure the wind resource.

He confirmed that the power will be sold to Eskom under the renewable energy feed-in tariff scheme. Kazunga says the wind farm is relatively close to Eskom's grid and Exxaro is currently involved in discussions with Eskom to establish how much capacity the local sub-station would be able to absorb.

The wind farm has been designed with an initial 50 MW capacity but this might be boosted to 100 MW depending on the results of the feasibility study.

Brand-se-Baai is located in the Western Cape close to Exxaro's Namakwa Sands operation. Kazunga says the company is also investigating co-generation opportunities arising from gases that are generated at the Namakwa Sands facility.

He says that the initial feasibility study of using methane gas for power generation had been done and indications are that about 300 MW of power could be forthcoming from this source. The gas at Namakwa Sands is currently being flared.

According to Exxaro it is also working on a concentrated solar power project at Lephalale and an option is to use a solar hybrid technology that allows the solar plant to be augmented with gas or other fossil fuels to keep the power generation capacity stable.

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Nuclear plant to close early

The Oyster Creek nuclear reactor in New Jersey is to be shut down at least ten years before its licence expires after it reached a deal with environmental regulators to operate it without building costly cooling towers. Exelon Nuclear, which owns the reactor has been negotiating with governor Chris Christie.

If Exelon was forced to install the cooling towers it would cost more than the current value of the plant according to Christopher Crane, chief nuclear officer at the company. The cooling towers will prevent the company from pumping hot water in Barnegat Bay.

The plant is the oldest operating nuclear facility in the United States. It was built in 1969 by the Jersey Central Power and Light Company. Exelon bought a 50 percent stake in the plant in 2000 and, in 2002 it bought the remaining shares as well. It paid about $10-million for the plant but has spent more than $100-million on it since 2000. Crane says that many of its parts need to be replaced before 2019 and because these are expensive the plant might be shut down before then.

It is likely that another nuclear plant at Indian Point on the Hudson River in Westchester County could also be forced to build cooling towers because of fears among environmentalists about the effects of discharging hot water into the river.

Oyster Creed has a capacity of 630 MW and was the first large-scale commercial reactor built in the country. It currently supplies about six percent of New Jersey's electricity.

Africa could be world's breadbasket

Improvements to Africa's infrastructure, along with greater mechanisation and the use of genetically modified agricultural crops could transform Africa into the breadbasket of the world according to the book by Harvard University professor Calestous Juma.

He has called on African leaders to make agricultural expansion a central feature of all decision-making on the continent.

The findings have been presented to African leaders in Tanzania and the presidents of Tanzania, Kenya, Uganda, Rwanda and Burundi are holding an informal summit to discuss African food security and climate change.

He says that farms must be mechanised, must build proper storage and processing facilities, boost biotechnology initiatives and used genetically modified crops to bring about benefits for Africa.

Juma says the roads and railways infrastructure in each of the African country must be improved along with electricity distribution to provide stable sources of power to farmers. Power, he says, is needed for irrigation, harvesting and proper storage of agricultural produce.

At this stage African countries are investing less than ten percent of their gross domestic product in agricultural projects according to George Mukkath, director of programmes at the charity, Farm Africa.

In Africa there are currently just 1,25 tractors per 100 square kilometres compared with 200 in other parts of the world. About 3,6 percent of Africa's croplands are irrigated compared with 18,4 percent in other parts of the world.

Africa produces just nine kilograms of food from each hectare of fertilised farmland whereas other countries in the rest of the world produce about 100 kgs.

Juma's book is entitled The New Harvest

Sailing through space may be a reality

An old fairy tale written in the late-19th Century entitled The Ship that Sailed to Mars might not be as far-fetched as some scientists originally imagined. Just as air causes lift on the wings of an aeroplane, light can do the same thing. And, like the aerofoil concept of wings, researchers are making use of the radiation pressure of light to steer solar sails for a spacecraft propulsion system.

Researchers at the Rochester Institute of Technology (RIT) says that each photon — or packet of light—carries its own momentum and this 'lightfoil' works by gathering the momentum of light as it passes through a material. The radiation pressure is considered as a fuel-free source of propulsion for long-range space missions using a solar sail to gather momentum from the Sun's rays. It is thought that such a spacecraft could

travel at a significant fraction of the speed of light. According to Grover Swarzlander of the RIT, computer simulations based on a semi-cylindrical glass rod were used to see what would happen when a beam of unfocused light was shone onto it.

They discovered that the glass rods experienced lift but that at several angles the rod tended to align itself. Swarzlander says the surprising thing is that the glass rod had different positions of rotational equilibrium so that it would roll to a given position, stay there and continue to undergo lift.

The team then designed tiny glass rods that are less than a hair's breadth in diameter to prove the principle. The rods were floated in water and a laser shone through them. They behaved in exactly the same way as the simulations had predicted. He says that it is surprising that no one had reached the same conclusion before, as the radiation pressure effect is widely known. He says that one of the problems with solar sails is that they are not always aligned to the starlight so self-alignment based on those elements would have real advantages for any craft using solar sails.

He says that the group plans to continue to optimise the shape of their lightfoils and then to move to a microscopic regime to see if small particles, about the size of biological tissue, can be tethered together to form the light foils. In June this year Japanese scientists unfurled the Ikaros solar sail, a 200 square metre membrane that was attached to a small disc-shaped spacecraft. Researchers working on this project believe that a solar sail will be a simple means of propulsion in space. The Ikaros sail was deployed about 7,7-million kilometres away from the Earth. Researchers at the Japanese Space Agency say that while the solar force is tiny, over time it should produce a considerable velocity.

It says that while solar sails will not replace conventional propulsion systems such as chemical thrusters they do have the potential to play a greater role in certain types of space missions.

Hi Paddy

I have just recently become an SAIEE member and really enjoy reading WattNow. Just a few comments from a concerned young engineer finding my feet in the power engineering industry. My comments concern the proposed Independent System Market operator (ISMO) that should come into effect in the near future in South Africa.

It is obvious that if Eskom continues to wholly own and operate the transmission/distribution network in South Africa that a conflict of interests arises in that they can determine (once the relevant studies have been performed and a submission to NERSA has been made) who, where and how much each prospecting IPP can connect to the grid.

One would hope that the process would be fair and transparent and Eskom would exercise reason in their studies to allow IPPs to play a part in the South Africa's energy future. Ideally, the process would be administered outside of Eskom anyway but for now the ring-fencing of a division inside Eskom performing this function should suffice.

Assuming that all IPPs are treated fairly and transparently, IPPs should flourish and enable expedited connection of new generation to fill the gap in generation that Eskom is forecasting in the next 3-5 years. The importance of IPPs in South Africa's energy future should not be understated.

However, another aspect that is not so heavily treated is the system operations aspects.

Currently, Eskom has the expertise and knowledge of the network that enables them to operate it safely and securely. If an ISMO that is outside Eskom is initiated without the correct due diligence to ensure technical know-how and system stability is maintained, the entire network could be compromised.

Various issues of system stability, as a result of a lack of knowledge of who is responsible for ancillary services among other things, have occurred in the US and Europe. This was, in part, due to a lack of transparency in the system as a whole (IPPs were only worried about pushing out MWs and supporting localised issues and not helping to support and secure the system as a whole).

This has resulted in many system incidents that could have been averted if a holistic view was taken and the rights and responsibilities of the parties were clearly defined (in the right proportion).

I guess all that I am trying to say is that it is extremely important for the entire process to be transparent and fair, for NERSA and Eskom (in collaboration) to be very meticulous in defining the rights and responsibilities of the buyer and seller and that the requirements for new IPPs must adhere be clearly defined and adhered to.

Regards
Jarrad Wright

Dear Paddy,

First of all, let me offer my sincere congratulations for your prestigious award!

I must confirm that you are still an unwavering promoter of the engineering profession despite the uphill battles that engineers are facing. I am also grateful that you were willing to publish my letter about the great joys and pitfalls when choosing an engineering career. After retirement I remained in teaching and research for awhile, but heard the clarion call of the future. I have therefore undertaken a second albeit unpaid but thoroughly enjoyable, degreed study in human physiology, biochemistry, pharmacology and molecular genetics.

As someone said, the 19th century belonged to chemistry, the 20th to physics and engineering, while the 21st is increasingly dominated by biology, as also attested to by the several recently published articles in WATTNOW. What attracted me to these studies?

The countless surprising and quite astounding analogies between industrial control engineering processes and physiological control processes.

In jest, I once said that I used to practise "industrial homeostasis". Of course, it is a quite different world and it was not easy to switch from engineering, where experimental and design results can be mathematically predicted or at least estimated, to biology, where enormous amounts of data must be memorized, experiments require trial-and-error methods and experimental research techniques require many years of practical learning.

Yet one gains an insight into medical science and health issues, understands diseases, medication and blood tests, and can meaningfully work with your physicians (that is, with those willing to cooperate), and know your body better.

As a subject of lifelong learning, I would recommend it to retired electronic and industrial control engineers.

Regards,
Prof.Ian Shaw,PrEng

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South Africa gets access to 'energy university'

South Africa is ripe for the countrywide adoption of energy saving as well as energy efficiency technologies and methodologies as demand for electricity and its cost continue to steadily climb. New generation capacity, in the form of the Medupi and Kusile power stations, now under construction, will only come onto the grid several years from now.

However, it will take more than new generation capacity to provide a long term energy solution for South Africa. With this in mind, Schneider Electric South Africa believes its vendor-neutral online Energy University, which provides free and easy access to practical education on energy management across the board, is highly appropriate for the local industry.

"Our many years of experience as an international organisation involved in energy distribution and management worldwide confirm that energy consumption can be reduced by up to 30 percent through the implementation of new energy efficiency technologies and systematic, enlightened engineering practice," says Gys Snyman, vice president for energy efficiency and global specialist in energy management, Schneider Electric South Africa.

Adding that as the foundation for the worldwide adoption of an energy efficient approach is knowledge, education and training, Snyman says that Schneider Electric's Free Energy University "is a highly practical and innovative means of ensuring that all future electrical engineers and electricians are aware of and trained in the energy efficiency approach to power generation, distribution and consumption".

An e-learning website, the Schneider Electric Energy University offers foundational courses that encourage personnel employed within the electrical industry or students aiming to become involved in the industry, to become better equipped to deal with the energy efficiency and conservation challenges being presented today.

Snyman says that the Energy University site provides current information and professional training on energy efficiency concepts and best practice.

"Not only will students become proficient in energy saving, they will develop into more valuable employees for their companies with the capability to not only meet today's energy challenges, but also anticipate and prepare for those of the future."

The success of the Energy University has been such that more than 21 000 learners have registered since its launch in June 2009 and more than 45 000 enquiries have been received from 120 countries.

About 85 percent of users agree they would recommend a course to others, while 87 percent agreed their classes were easily applicable to their fields and 90 percent said they intended taking another class.

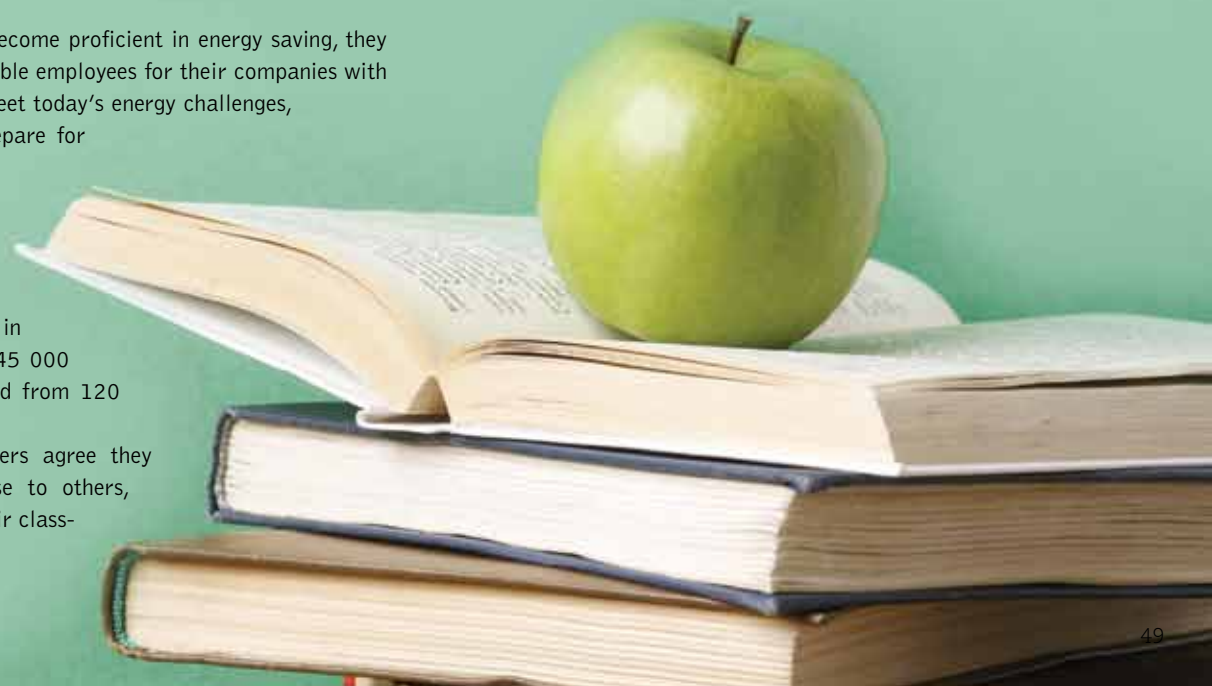
Twenty-one new courses were added to the curriculum in 2010 to increase the educational offering to 34. Courses are available in English, German, and Spanish, with French, Italian, Brazilian, Portuguese and Russian launching soon. Additionally, Energy University has now launched a fully translated version of the site in Chinese, making it the first online energy efficiency programme available in that country.

Courses added in 2010 include:

- Demand Response and the Smart Grid;
- Measuring and Benchmarking Energy Performance;
- Energy Efficiency Units and Concepts;
- Combined Heat and Power (Cogeneration);
- Energy Efficiency with Building Automation Systems;
- Financing and Performance Contracting for Energy Efficient Projects;
- Energy Rate Structures: Concepts and Unit Pricing;
- Energy Audits Instrumentation;
- HVAC and Psychometric Charts; and
- Industrial Insulation.

Each course can typically be completed in less than one hour and the added ease of an online platform makes learning convenient and accessible from any Internet-ready computer. The self-paced learning experience is enhanced by an accompanying quiz for success measurement and preparation for the certification to be launched in 2011.

The certification verifies that a user has a broad understanding of energy management and is able to effectively engage in audit and measurement, prioritisation, selection, management and maintenance of solutions, and promotion of energy awareness.



The South African Institute of Electrical Engineers
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Managing electricity demand key to sustainable power

Integrated demand side management is the best way to prevent rolling blackouts in 2011 and 2012 when Eskom generation capacity will be tested to the limit prior to new generation capacity coming on stream.

Eskom's Andrew Etzinger was the keynote speaker at the SAIEE's annual breakfast where he outlined what the utility organisation is doing to prevent power disruptions for South Africa.

In 2008, when coal supply problems and an intensive maintenance programme converged on South Africans, rolling blackouts were widespread, the mining companies ground to a halt and industry and commercial activity was widely disrupted.

Eskom is currently working with its stakeholders in the residential sector, in industry, mining and commercial operations to prevent a similar situation in 2011 and 2012.

He says that energy efficiency and demand management combined to provide:

- Security of supply
- Low cost alternative to building new capacity
- Competitiveness – particularly in bringing new technologies to market;
- Environmental benefits and greater levels of sustainability.

Referring to the security of supply, Etzinger points out that in the short term, the reserve margin is a key factor in maintaining the supply because power outages have a seriously detrimental impact on the economy as a whole.

"The reality is that subsidising integrated demand management technologies or even forcing firms to implement more energy-efficient systems is far less damaging for the economy than power outages," he says. "At the same time, integrated demand management is the cheapest way to create additional energy supplies because if you are using less energy then you can afford to generate less," he says.

He points out that the cost of building the infrastructure needed to generate one megawatt hour's worth of electricity is considerably more than the amount needed to fund an integrated demand management programme that will conserve one megawatt hour's worth of electricity.

"The sharp and concise point is that if you manage the electricity resource better you can reduce the overall amount of electricity needed to keep the country's lights on at all times," he says.

Etzinger says that energy conservation is not simply a problem that faces the people of South Africa but rather it affects all economies in the world. Because of this massive strides are being made in managing resources and implementing new technologies that make it energy usage more efficient.

"South Africa must remain open to new technologies that are developed in other markets around the world but, at the same time, must develop its own technologies to manage the local consumption of energy at all levels," he says.

Etzinger points out that in the mobile phone market, for example, enormous strides have been made in the past ten years to make phones more energy efficient and these have been implemented into the new gadgets that are available in South Africa within a few months of their launch overseas.

"Industries in South Africa must remain at the forefront of technology to remain internationally competitive," he says. "So the competitive edge applies both ways – in taking South African-made products to the foreign markets and bringing in those products that will increase energy efficiency in South Africa as well," he says.

Etzinger points out that global focus on the environment, couple with the search for sustainable energy solutions (mostly based on renewable resources) are fundamental requirements for the future.

"Carbon emissions and a reduction in greenhouse gases is no longer one of those nice-to-have concepts but, in terms of government policy, cutting emissions is an essential criteria for any new generation projects and will be adjudicated on those criteria," he says.

"However, it's important to recognised that an integrated demand management system promotes energy efficiency and as such can be a key tool for meeting a country's environmental goals," he says. "Again the principle is simple: use less and you emissions drop correspondingly."

Etzinger says that another benefit of effective integrated demand management is that it prolongs the life of non-renewable energy resources such as coal. "Fossil fuels have proved to be effective and reliable as a means of generating baseload power whereas renewable resources, including solar and wind must still create some kind or track record," he says.

Eskom has devised a programme that contains three main thrusts for the future. It comprises:

- Increasing the efficiency of equipment and appliances in South Africa using energy efficient lighting, solar water heating and other technologies. Almost R5,5-billion has been approved for these technologies as part of the Multi-Year Price Determination (MYPD) and to date about 43,5-million compact fluorescent lighting bulbs have been installed. Eskom is setting up further incentives for industry and households to increase energy efficiency levels.
- Creation of the virtual power station. This allows for flexibility so that non-essential loads can be controlled by systems operations so that the entire Eskom grid becomes more efficient. Eskom has issued requests-for-information that will allow more than 500 MW of power to be implemented before winter 2011 to stem possible supply disruptions.
- Eskom wants 250 of its largest industrial customers to cut electricity usage by 10% over the next couple of years and so far it has relied on voluntary implementation of these conservation measures. However, Etzinger warns that while there are no penalties for non-compliance with the targets at this point, that situation is unlikely to continue indefinitely.

Etzinger points out that the use of energy

efficient lighting by residential, commercial and industrial customers could reduce demand for electricity by 1 170 MW and a further 3 713 MW could be saved by using solar water heating and if stoves were converted to gas then this could lead to further savings of 2 144 MW.

"The total residential savings would amount to 8 762 MW if infra-red heating systems were implemented, heat pumps were used in the residential environment and if energy-efficient showerheads and water restricting devices were deployed in the domestic market," he says.

That's the equivalent of a the output of one large power station in South Africa," he says. In the industrial environment, the largest savings are likely to occur from switching to compressed air as an energy source rather than electricity where Eskom estimates that savings of 1 255MW could be achieved through the use of this technology among some of its customers.

Energy-efficient motors, variable speed drives and energy-efficient fans and pumps would combine to provide savings of a further 1 355 MW.

Annual SAIEE awards to worthy recipients

The South African Institute of Electrical Engineers presented their annual awards honouring individuals who have made outstanding contributions to electrical and electronic engineering in the country.

Presenting the awards during the Annual Banquet, held at the Wanderers Club in November, the President of the SAIEE, Dr Angus Hay, congratulated the three worthy recipients for their achievements on behalf of the Council and the 5 200 members of the Institute.

The Keith Plowden Young Achievers Award was presented to Sanjeeth Sewchurran from eThekwini Electricity (Durban City Council). This award, sponsored by Powertech Transformers, recognises a young person who, in addition to high achievement in electrical engineering, displays creativity, leadership and an infectious enthusiasm to succeed.

"Sanjeeth was extensively involved in and ultimately took over the supervision of a major project that now produces about 5 megawatts of electricity using the gaseous products from urban waste – an appropriate contribution to energy in South Africa at this time," said Hay. The SAIEE Engineer of the Year went to Fellow and Past President of the Institute, Mr Viv Crone, for his energetic voluntary work in promoting electrical science and its applications for the benefit of the SAIEE, its members and the South African community. "Viv has spent many hours of his valuable time and expertise in coaching and influencing young people to choose electrical engineering as a career – apart from his huge contribution to the Institute during his year as President in 2006 and subsequent valuable service on Council," Hay said. The award is sponsored by Actom.

The prestigious SAIEE President's Award was awarded to Mr Karel Pienaar, managing director of MTN South Africa, for his significant contribution to the communications networks in South Africa and indeed, across the continent of Africa. The President's Award recognises current major engineering contributions in any sector of electrical, electronic, telecommunications and computer engineering in South Africa.

"Karel Pienaar's major contributions have not only been in South Africa, where he began as the first employee of MTN, but also in Nigeria where, as the chief executive there, he oversaw the start-up of MTN's business in the country. Prior to becoming managing director of MTN SA, he was the chief technology and information officer of MTN Group," said Hay. This award is sponsored by Rotek Engineering.

President of the SAIEE, Dr Angus Hay, congratulating Sanjeeth Sewchurran on his award.

Students get accolades in the SAIEE awards

The National Student Project competition, organised by the South African Institute of Electrical Engineers was held at the University of Johannesburg's Sol Kerzner Hotel School complex and 12 students were invited to present their project to the judges.

The judging panel comprised Viv Crone, Hans van Groenendal, du Toit Grobler, Wayne Fisher, Peter Tolsma and Stan Bridgens and when the scores were compared the results were found to be remarkably similar, which may have made it slightly easier for the judges to select the winners.

It was interesting that communication formed a fundamental part of the presentation and Dr Angus Hay, President of the SAIEE picked up on this point and said that communication in the engineering community remained one of the fundamental tenets for successful project implementation. From a research perspective he referred to highly respected SAIEE's Africa Research Journal, which, he said, provides an ideal vehicle for all academics to publish their findings as it is the only peer-reviewed academic publication of its kind in Africa.

Chris Yelland of EE Publishers – who co-incidentally sponsored the event – spoke of his years as a professional engineer and recalled some of the tremendous experiences he had when he first started working in the profession. He is now fully involved in publishing engineering journals and claims that his experience in the publishing world has shown how critical it is for clear communication to be maintained at all times when engineers are involved in any project, regardless of its complexity.

The winners in the Universities of Technology category were:

- First prizes was awarded to Clement Venter of the Nelson Mandela Metropolitan University who presented a paper entitled An investigation into voltage transformers used for tariff metering of medium and high voltage loads and standard guidelines for its application.
- Second prize was awarded to Dane Chapman of the Tshwane University of Technology for his work entitled Renewable energy recovery for use in alternative power systems while third prize was award to Vikash Rameshar of the University of Johannesburg for the paper entitled Hydroponics control systems.

In the section for universities the judges chose the following:

- First prize was awarded to Robbie Theron of the University of the North West for his work entitled SMD prototyping reflow oven.
- The second prize went to Anna Zawilska of the University of KwaZulu-Natal for her work on Direction and hand gesture monitoring while the third prize went to Eric Marais of the University of Cape Town for his work entitled Theoretical resources assessment of marine current energy in the upper 200metres of the Agulhas Current flowing along South Africa's east coast.

The judges awarded their discretionary prize To Lauren Gritzman and Wanda Stransky of the University of the Witwatersrand for their work entitled An investigation of the use of electro-oculography for measuring eye movement and interfacing with an external device.

The tertiary institutions that participated in this event included the Cape Peninsula University of Technology, the Central University of Technology, Tshwane University of Technology, Nelson Mandela Metropolitan University, University of Johannesburg, the University of Cape Town, the University of Stellenbosch, the University of KwaZulu-Natal, the North-West University and the University of the Witwatersrand.

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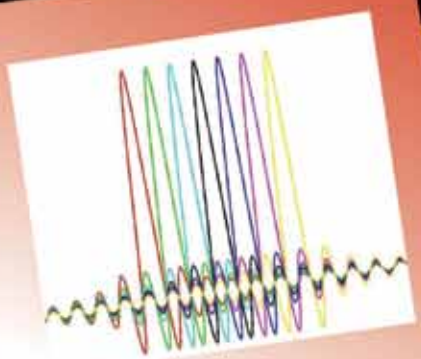

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