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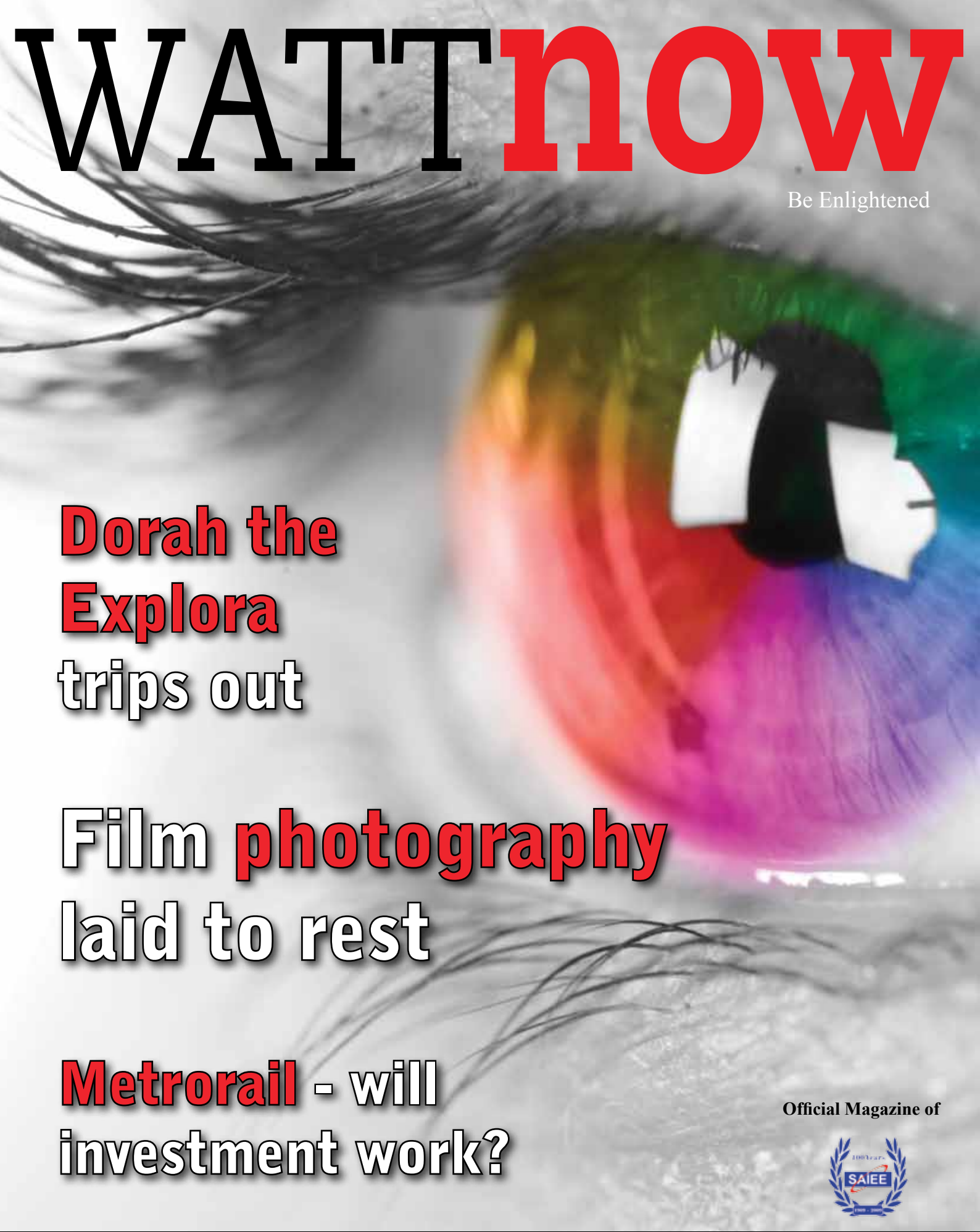

Dorah the Explora trips out

Film photography laid to rest

Metrorail - will investment work?

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Kodachrome dies – but long live the engineers

Engineers are not renowned for their sentimentality because, in general terms, I guess they're not a soppy lot anyway. The tough-as-nails approach seems to characterise the behaviour of most engineers and if you were to ask someone to draw a picture of a typical engineer, I'm reasonably certain that it would symbolise a no-nonsense practical woman with her feet firmly planted on the ground.

Of it might represent a bloke with the same qualities.

But I do think that most engineers, like the other more artistic folk who write editorial material or layout pages, will all be saddened by the demise of one of the most famous photographic companies in the world. Or at least of one of its most famous films.

At the end of 2010, Kodak announced that it is finally closing down the last Kodachrome processing plant and that people who may have unprocessed Kodachrome films locked away in a cupboard somewhere will never know what pictures are on that film.

The company had to do so because the demand for film has dropped so dramatically over the years that it was no longer financially viable to maintain the film processing units that once could be found on every continent on Earth.

More importantly, perhaps, the rise of digital photography has been so rapid and so impressive that digital cameras have now replaced film models in virtually every sphere of commercial or professional photography. Nowadays, press photographers carry computers, cameras and Internet devices with them all the time and within seconds of some particular event, they can beam their images around the world in the blink of an eye.

Images taken on a mobile phone camera are now being used on major news broadcasts or in the major dailies as a matter of routine. The quality of these images has improved by leaps and bounds, with Nokia, for instance, providing a 12+ megapixel camera in the phone itself. That's better quality than most point-and-shoot digital cameras that you can buy today.

Moreover, Leica has launched a 57+-megapixel that will cost upwards of R200 000 for the body only but will provide outstanding picture quality. Your other big brands, like Nikon, Canon, Pentax and Olympus too have all invested billions of dollars in the research and development projects that have led to the birth of this miraculous technology.

And, of course, behind every digital camera is a squadron of clever (yes, you've guessed it) engineers who are making sure that the camera can do what a camera is meant to do: capture high-quality images at speed and with incredible accuracy.

Of course some of the purists will turn around and say that "digital photography can never replace film" in much the same vein as the musical purists will say that digital compact disks are just not as good as the original (and scratchy) vinyl records that played such a huge role in the lives of Baby Boomers.

But my own view is that the purists are actually wrong.

Like anything, progress leads to new ways of doing things and from a personal perspective (as a person who once earned a living taking news pictures) I believe that the digital cameras are marvels of the modern age and, as people get to know and understand the technology better, they will be producing the same sort of legendary pictures that great news photographers like Kevin Carter or Robert Capa produced in their time. Because the beauty of the picture lies not in the technology but in the content.

And, for this reason, I am one of the first to pay tribute to those electronics engineers who made it possible for us and who have brought photography into the hands of almost every person in the modern world.

Without those engineers – plodding blokes with their large Size Tens firmly rooted to the ground – we would not have had this revolution. A revolution that killed Kodak's best-loved film but gave everyone a digital Box Brownie instead.

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5> WATT'S GOING ON?

Billions to be spent on retail banking; The Life and Death of Photography; Mobile phones spur electricity demand in Africa; Batteries – a renewable energy resource.

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Billions to be spent on retail banking

Global spending on retail banking technology will increase by 24 percent over the next five years, reaching $132-billion, according to figures compiled by Ovum. However Europe will have the lowest growth of all the regions, despite being the second biggest market in terms of overall spend.

Independent technology analyst, Jaroslaw Knapik believes the increase in investment will be driven by the need to grow revenues and improve customers' trust. This will lead to accelerated investment in online and mobile banking, technology in in emerging markets.

Ovum's figures show that global investment in technology to allow customers to access banking services via the internet will grow by 33 percent from 2010 to 2015, climbing to $9,7-billion.

"There is a strong focus on online platforms and their extension onto mobile devices and tablets, given their ability to service clients at a lower cost. In addition, technologies that allows 'smarter' selling and servicing, such as customer analytics and channel integration are expected grow in future," he says.

According to Knapik ever increasing regulatory requirements will also drive investment into technologies that reduce costs, such as data management, business intelligence and analytics. Global spending on various middle-office components, such as risk management, anti-fraud, compliance or performance management, based on these technologies, will experience growth of 30 percent from 2010 to 2015, reaching $7,2-billion.

The emerging markets will also demonstrate strong growth with the Asia Pacific region growing by 49 percent from 2010 to 2015 to $12,7-billion. Middle East and Africa will grow by 36 percent during the same period to $5,5-billion.

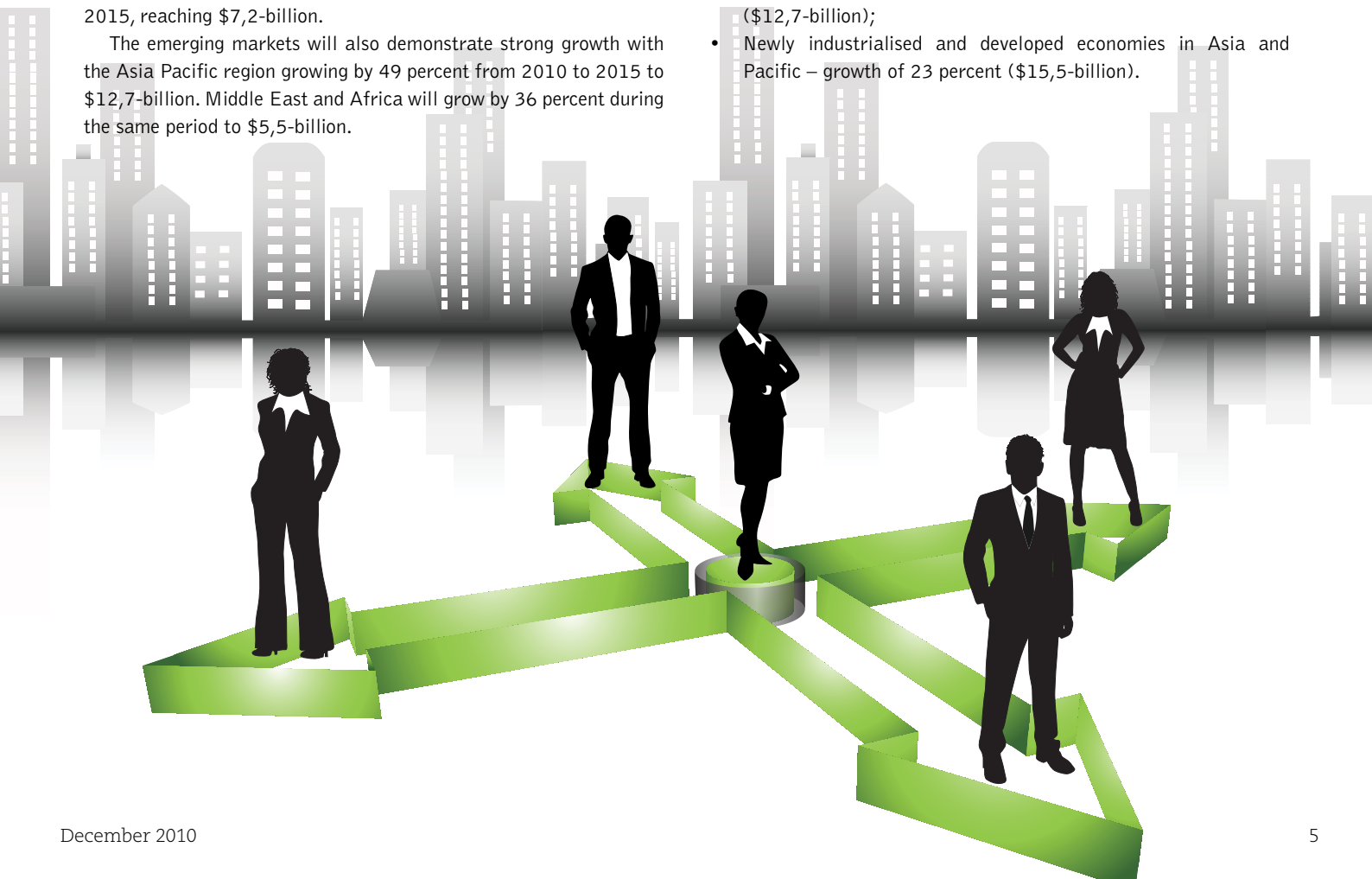
An increase in spending on technology within the branch networks of banking groups is expected be one of the major driving forces behind this rise in the emerging markets. The area will experience global growth of 28 percent over the next five years to reach $18,6-billion. As new branches open in the less saturated markets, further investments new operations will be required.

While Europe is the second biggest market in terms of overall expenditure, the investment will climb $43-billion by 2015 but the five-year growth cycle is only equivalent to about 19 percent, the lowest of all the regions.

"Recent budget crises within European governments are having a negative impact on the financial sector and consequently growth in retail banking technology in Europe will be slower than in other regions," says Knapik.

The expenditure breakdown within the different regions between 2010 and 2015 is estimated as:

- South and Central America - growth of 29 percent ($3,9-billion);
- North America - growth of 23 percent ($50,2-billion);
- Central and Eastern Europe - growth of 21 percent ($3,6-billion);
- Western Europe - growth of 19 percent $40,1-billion);
- Middle East - growth of 30 percent ($2,2-billion);
- Africa - growth of 30 percent ($2,2-billion).
- Emerging economies in Asia and Pacific – growth of 49 percent ($12,7-billion);
- Newly industrialised and developed economies in Asia and Pacific – growth of 23 percent ($15,5-billion).



The Life and Death of Photography

By Gavin Chait

'Afghan Girl' is one of the most famous photographs of all time. The image of Sharbat Gula appeared on the cover of National Geographic in 1984.

In 2009 Steve McCurry – that image's photographer – was in Dwayne's Photo Service in Parsons, Wichita, chatting with Grant Steinle, one of Dwayne's vice presidents. 'Afghan Girl' was shot on Kodachrome film and McCurry was discussing a roll of 36 slides he wished to have processed.

"Then we went to India, where I photographed a tribe that is actually on the verge of extinction. It's actually disappearing, the same way as Kodachrome," he told Steinle.

McCurry's roll of Kodachrome was the last to roll out of Kodak's manufacturing plant, ending the most famous brand of colour reversal film, first manufactured in 1935. Dwayne's is the last processor of that film and is to end all Kodachrome support in December 2010.

Leica discontinued the R9 SLR and R-series lenses in March 2009. Canon is to stop producing its EOS film cameras.

The source for this disruption is simple: digital photography.

Considering how dramatic the eruption of camera phones has been it may surprise you to know how far back the technology dates. Charge-coupled devices were invented in 1969 at AT&T Bell Labs by Willard Boyle and George E Smith. They were working on converting semiconductor bubble memory – a type of non-volatile computer memory that was displaced by low-cost hard-drives – using the new theory of transistors.

"During the nineteen-forties, a major problem began to appear in the telephone-switching network. As the number of subscribers increased, the complexity of the network increased even faster. Some of the switching was done manually. It had been jokingly said, that soon everyone in the country would be working for the telephone company as telephone operators. The real problem was the number of electromagnetic relays that were needed. They were big, expensive, and unreliable. I once saw the machine that made them. It was the size of a small steam locomotive and sounded like one. Plastic, wire, and metal plate went in one end and relays came out the other," recalls Boyle about the process and discoveries leading up to his invention.

That was the problem solved by the invention of the transistor.

"The invention of the CCD took place one afternoon over one of our frequent brainstorming sessions at the blackboard. We began drawing a diagram, and before it was finished, we knew we had something special. After a few weeks of work, George asked the 'shop' to make a model of our device. Somewhat to our surprise, the very first model worked as we had hoped. The first 3-bit device was born," he says.

That device would be used as a shift register, transferring a charge along a series of capacitors along the surface of a semiconductor in time with a clock. Michael Tompsett and Gil Amelio joined Smith to build an experimental device using a row of closely-spaced metal squares on an oxidised silicon surface linked with wire bonds.

The first working CCD was built in 1970 as an integrated circuit with an 8-bit shift register. That sparked other technology companies to enter research, including FairChild Semiconductor, RCA and Texas Instruments.

In 1974 Fairchild commercialised a linear 500-element device and a 2D 100x100 pixel chip. Sony then joined the fray under the direction of Kazuo Iwama who developed the mass production that led to the financial success of camcorders.

Boyle and Smith won the 2009 Nobel Prize for Physics 'for the invention of an imaging semiconductor circuit – the CCD sensor'.

"It is heartening for us to see that the use of CCDs as solid state imaging devices initiated a revolution in which photographic film and electron beam imaging tubes were relegated to history. As part of the accelerating rise in information technology, it has helped transform the way we live our lives," said Smith in his Nobel speech.

"One application that makes maximum use of the device's characteristics is as-

tronomy. CCDs have been used to gaze much deeper and more accurately into the universe than ever before. This has resulted from the increased efficiency, lower noise, and larger dynamic range using CCDs than that which can be attained with photographic film."

Indeed, astronomers were the most enthusiastic early users of CCDs. If you've ever logged onto the NASA website to enjoy the Hubble Telescope images then you've been viewing CCD creations.

CCDs have a photoactive epitaxial layer of silicon bonded to a transmission region which is the shift register proper. Any image projected through a lens onto the photoactive region causes these capacitors to accumulate an electric charge in direct proportion to the light density experienced. After exposure, the control circuit shifts the charge from each capacitor to its neighbour, shifting the charge bitwise until it is captured in a charge amplifier. In this way, shifting the charges, the image is converted into a sequence of voltages. The voltages can then be sampled, digitised and stored in memory as a raw image.

The first images were stored in analogue and a continuous signal would be returned as video.

Astronomy, with its need for lengthy exposures and the ability to splice large numbers of images together to produce contiguous visualisations, could be said to have led to much of the developments we now take for granted. The Sloan Digital Sky Survey, for instance, uses a drift-scanning technique in which a fixed CCD behaves like a tracking telescope to follow the motion of the sky.

Digital colour cameras usually use a Bayer mask in which a square of four pixels is filtered by one red, one blue and two green to split the colour. This results in lower resolution because of the reduced luminance. A better solution is a 3CCD device which uses a dichroic beam splitter prism that splits the image into red, green and blue components. Professional and semi-professional devices use this technology.

After that CCDs become more varied and complex. However, they have a problem. The larger a CCD becomes in order to capture ever greater resolution, the slower it gets as each pixel has to be bitwise processed. In addition, each pixel continues to collect light so, if the processing doesn't take place fast enough, the image can be corrupted.

More expensive CCDs have attempted to solve this problem. Intensified CCDs enable shutter times as low as 200 picoseconds.

By the mid-1980s and early 1990s CCDs were well-established as a stable technology platform. They were no threat to camera film. That disruption was just brewing.

Another technology, two years older than CCDs, was about to undergo a transformation.

The complementary metal-oxide-semiconductor (CMOS) is both the process and foundation for the integrated circuits used in microprocessors and digital logic circuits. In 1963, while working at Fairchild Semiconductor, Frank Wanlass invented the CMOS logic circuit and was awarded a patent for it in 1967. He died on 9 September 2010 having never won a Nobel Prize, but having changed the world.

Wanlass' demonstration CMOS drew six times less power than the best bipolar circuits of the day making battery-powered devices suddenly feasible. The digital watch owes its existence to Frank Wanlass.

In addition, CMOS devices have high noise immunity. Power is only drawn while the transistors are switching between on and off states. CMOS went on to have a fantastic career as the core of logic gates in processors and low-cost electronic devices. Though CMOS-type pixel sensors were attempted during the 1970s they were never as stable as CCD.

In 1993, while at NASA's Jet Propulsion Laboratory, Eric Fossum invented the CMOS active pixel sensor. The term itself was coined by Tsutomu Nakamura while working on the Charge Modulation Device APS at Olympus. Fossum went on to develop the APS further, as a sensor using an intra-pixel charge transferred along with an in-pixel amplifier to achieve correlated double sampling (CDS) and low temporal noise operations.

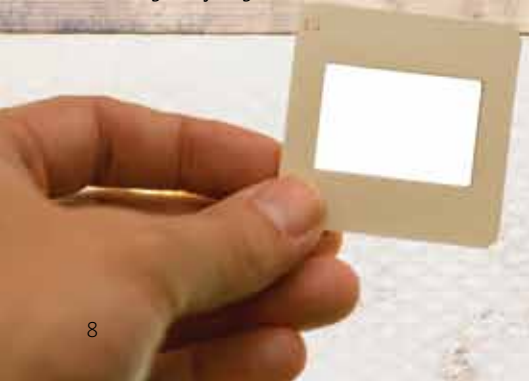
The title of his 1993 paper boldly declared: "Active Pixel Sensors: Are CCDs Dinosaurs?" In 1995 he founded Photobit Corporation to commercialise his technology. Some of the first devices to embed the new chips were low-cost web cameras.

APS are fast, stable and scalable. They consumer little power, have less lag and can be made on cheaper and more widely-available production lines. They are also simpler, combining both sensor and processing on the same integrated circuit.

They are now used in digital radiography, optical mice, endoscopy cameras, high-speed motion-capture cameras and ... camera phones.

Canon, Kodak and Olympus all brought out early prototype cameras with mobile phone capability throughout the 1990s. On 11 June 1997, Philippe Kahn became the first person to instantly share digital pictures online, posting images of his newly-born daughter Sophie onto the Internet.

That capacity for instant communication and engagement triggered a rush. Most of the early camera-phones were in Japan starting in 1997. Philippe Kahn was promoting his technology and his company, LightSurf, collaborated with Sha-Mail in Japan to release the J-Phone in 2001 based on APS chips. In the US, Sprint launched the first camera phones in 2004 with phones manufactured by Sanyo but developed and managed by LightSurf.



By 2003 more camera-phones were being sold than stand-alone digital cameras. In 2004 Nokia became the world's largest digital camera brand. In 2006 half the world's phones had cameras built in. In 2008 Nokia became the world's biggest camera seller of any type of camera and more than 1.9 billion camera-phones had been sold.

Kodak wasn't the only victim of this astonishing growth. Minolta and Konica both left the camera business entirely.

The impact of ubiquitous cameras has had a dramatic impact on society. New hosting services like YouTube and Flickr depend on a steady stream of new content created by these devices.

Two billion videos a day are watched on YouTube while every minute, 24 hours of video is uploaded. Flickr hosts five billion images.

More than that, though, are the immediacy of these images. From Charlie Bit My Finger, a viral video that has now been viewed 245 million times, to the 7 July 2005 London terrorist bombings; our experience of the world has changed completely.

Countries like Iran, China and Saudi Arabia now routinely ban the use of mobile phones to prevent pro-democracy activists and other social protests. Citizen journalism – and its capacity for social change – would never have been possible without readily-available digital cameras on mobile phones.

Yet digital photography is only just beginning.

In 2007 the first camera produced by the Red Digital Cinema Camera Company was released; the Red One. The company was created and financed by Oakley founder, Jim Jannard, with the simple objective of reinventing the camera industry.

The first versions were limited to resolutions of 4,096 by 2,304 pixels. Their latest proposals are for an expansion up to 28,000 horizontal pixels, for a 261 megapixel sensor. Red One was designed as a modular camera that could be upgraded rather than being replaced and is aimed unflinchingly at the cinema photography industry.

Notable recent movies shot using Red Ones include District 9, which used nine Red Ones, and The Social Network, shot at 4,096 pixel resolution.

And the innovations keep coming. Microsoft's Photosynth allows digital images to be recombined to create 3D models from collections. They're using this, along with geolocation features embedded in many digital photographs, to collate tourist images uploaded to the internet to create virtual models of famous tourist sites.

This is a long way in innovation but short in time since 1992 when Tim Berners-Lee published an image of CERN house band, Les Horribles Cernettes, as the first ever Internet image.

The most recent, and successful, incarnation of digital imaging is 3D movies. The biggest, and the one that launched the wave, is James Cameron's epic Avatar which – to date – has grossed over $2 billion.

Cameron spent a decade developing his fusion camera system which has two cameras designed to function and focus in tandem much like human binocular vision (although Cameron's digital cameras sit one on top of the other).

This separation of perspective permits a 3D image to be created which can also produce visual perspective. Post-production 3D lacks this visual perspective which can be immensely tiring to watch.

The amount of pure processing power required to deliver Avatar is breath-taking, especially in comparison to the technology originally used to place living human beings on the moon.

Microsoft created a digital asset management system called Gaia to keep track and coordinate the various stages of the digital processing.

Weta Digital in New Zealand created a server farm called Mari, which used 4 000 HP servers, with 35 000 processor cores running Linux and a grid engine cluster manager to host and render it all. Creating the Na'vi characters required over a petabyte of digital storage and each minute of footage occupies 17.28 gigabytes.

Disruptive innovation has knocked the manufacturers of photographic film. In exchange millions of new jobs have been created in a magnificent range of industries.

Behind all this stands the creative genius of a few great engineers and scientists who invented technology that has become ubiquitous and life changing.

Mobile phones spur electricity demand in Africa

While mobile phone usage throughout Africa grows exponentially making it the fastest growing market in the world today, one minor problem seems to avert many of the cellular phone manufacturers and service providers: how do rural African keep their phone batteries charged?

Enterprising traders connected to Kenya's power grid, for example, charge about 25 Shillings to recharge a cellular phone but the service is in such demand in the rural village of Mogotio that the phone must be left with the store-owner for three days.

Increasingly, people in Kenya who live in small rural settlements are clubbing together to buy a generator or, more sensibly, a small solar power system that can be erected on the roof of a hut.

A Chinese solar power system capable of charging many cell phones costs about $80, (KS 6 500) a small fortune in poverty-sticken rural communities where people are earning just a fraction of that amount each month. The solar power system is sufficiently powerful to charge the community cell phones and provide four overhead lights for the village itself.

This is typical of many enterprising Africans in different countries around the continent who are resorting to solar power for the basic electricity supply they need to provide simple lighting and, most importantly, power for mobile phone batteries.

In the Kiptusuri district, 63 families have now installed solar power systems and Adam Kendall, head of the sub-Saharan Africa power practice for McKinsey & Company says that renewable energy becomes more and more important in the less and less developed markets.

The United Nations estimates that about 1,5-billion people throughout the world live without electricity. In Kenya the picture is hopelessly woeful with about 85 percent of the population having not access to electricity. Around the world there are about three billion people who use wood and charcoal to prepare food.

However, there is no reliable data about the number of people who are using off-grid energy sources – such as small solar systems or generators – as these are most often installed by individuals or by tiny non-governmental organisations. Dana Younger, a senior renewable energy advisor at the International Finance Corporation – the private lending arm of the World Bank – says that the trend is accelerating rapidly.

Younger says that the small and cheap solar panels and high-efficiency LED lights can light a room with just four Watts of power compared with 60 for an incandescent bulb, resulting in the fact that small solar power systems can deliver useful amounts of electricity for even the poor people of the world.

He says herders living in Inner Mongolia have mounted solar cells on the top of their yurts – a portable, felt-covered, wood lattice-framed dwelling structure – to provide a constant source of power.

The solar systems are being sold and used in Ethiopia, Uganda, Malawi and Ghana as well as in Kenya and energy entrepreneur, Francis Hillman, has seen such a demand for these systems that he was shifted his Eritrea-based business Phaesun Asmara away from concentrating on large solar projects to supplying tiny rooftop systems for developing countries. Younger says that traditionally electricity supplies relied on a huge, government-owned utility to provide electricity and gradually, as resources permitted, the electricity grid was extended to rural communities.

However, the advent of small solar systems means that this is no longer the case and in Kenya – where the government has failed to extend the grid – individuals are using the smaller systems to provide the most basic forms of energy.

He points out that off-grid power in Africa is providing a solution that the continent has been unable to resolve because each country lacks the resources to embark on huge infrastructure projects, build power stations and extend the limited electricity grids. Minoru Takada, chief of the United Nations Development Program's sustainable energy division says that government funds that promote giant renewable energy projects are easy to monitor and finance whereas its almost impossible to monitor 10-million home-scale solar systems installed on mud huts across the continent.

He says that because of this, money does not flow into the poorest areas of Africa. Of the $162-billion invested in renewable energy last year, experts estimate that $44-billion was spent in China, India and Brazil collectively but just $7,5-billion was spent in poor countries such as those in Africa.

Only six or seven percent of solar panels are made to produce electricity that does not feed into a grid but there are more models emerging gradually as entrepreneurs see the need for these systems.

For instance, Husk Power Systems, supported by private investment and non-profit funding, has built 60 village power plants in India that produce electricity from rice















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husks. In Nepal and Indonesia the UNDP has helped to finance the construction of tiny hydro-electric plants for remote mountain communities. Morocco has subsidised home solar systems costing $100 each to get electricity to remote areas where it is not cost-effective to extend the national electricity grid. But it is the explosion of mobile telephony in Africa that has really caused a major shift in the demand for electricity.

M-Pesa, Kenya's largest mobile phone money transfer system today handles an annual cash-flow equivalent to just over ten percent of the country's gross domestic product. Most transactions are for tiny denominations that seldom exceed about $20.

In another Kenyan village, Lochorai, two subsitence farmers have stopped farming and are now selling and installing energy-efficient wood-burning stoves made of clay and metal that cost just $5. The fuel-efficient stoves cut wood consumption by more than 50 percent. In Tumsifu, a slightly more prosperous village of dairy farmers, residents collect the manure from the cows and store it in an underground tank to make biogas that is pumped via a rubber tube to a communal gas stove. The system cost the village $400 to install.

For individual villagers, the smallest solar system – made by Firefly LED – costs $12 and comprises a small solar panel that can be placed in a window or on the roof and can provide enough electricity for a single desk lamp and a phone charger. Larger and more expensive units can run radios and even black-and-white televisions sets.

Of course these initiatives are a far cry from the South African scenario where thousands of squatters and township residents have illegal connections to an electricity grid and where electricity theft is equivalent to the entire output of a medium-sized coal fired power station.

But that's because South Africa has electricity and currently has an electricity grid.

In the rural communities of South Africa the picture is much the same as in other parts of Africa, although there are government initiatives underway, through the state-owned power utility, Eskom, to extend the grid nationally and eventually provide every community with easy access to electricity.

Time will tell if this is a dream or a reality.

Batteries – a renewable energy resource

Since 2008 South Africans have dreaded load shedding and the crises caused many consumers to rush out and buy generators. But did consumers consider the implications of their expensive investments?

In many cases, the money could have been better spent on alternative solutions claims Win Kurzyca, marketing manager, renewable energy for First National Battery. "It's important to understand that load shedding is not a result of incompetence. It's a form of load management, allowing finite resources to be distributed where they are needed most," says Kurzyca. "This is why residential areas are hard hit during office hours. Eskom is distributing the power to industry so that South Africa's economy can continue to function," he says. In addition to power shortages, the cost of electricity and proposed rate increases are a major concern for all South Africans.

He says that Eskom currently has roughly 40 000 MW of installed generating capacity and the current forecasts show that the country will need another 7 000 MW by 2015. The Medupi Power Station, a dry-cooled coal fired power station currently under construction in Lephalale, will provide a further 4 800MW once the last unit is commissioned. The Kusile Power station project is running behind schedule because of funding problems. Given this enormous capital expenditure, Eskom has little option but to increase its tariffs in order to fund its future capacity expansion.

"Given the expected demand growth, extra power from Medupi and Kusile will all be taken up, leaving the low margin unchanged. So consumers must start looking at ways to augment their power needs and there are for private and industrial users that will save money, enhance productivity and protect the environment," claims Kurzyca.

He says that anyone who thought that a generator was the only viable option should think again because a 10 kW generator will provide enough power for a few lights and a television set but actually only 4 kW of the available energy is being used. So 6 kW is being wasted," he says.

Apparently First National Battery has designed an alternative energy solution that performs load management and stores unused power in batteries. "This means that every cent you spend on generating the power, whether with a generator, solar or wind, this power will be stored and then used. Industrial users can store power generated at off-peak times in the batteries and then use this stored power during peak times.

"When generators were sold en masse to consumers, many retailers did not have the know-how to advise consumers and on how to use them efficiently and safely. Generator owners should be using a load management solution 24 hours a day, storing excess power when the generator or solar panels are operational, and distributing it when required," claims Kurzyca. He says that First National Battery will provide a customised solution for each of its customers based on the assessment of energy auditor.

To find out more about alternative energy solutions or to have an energy auditor assess your power needs, contact First National Battery 0800 112 600.

Billions to improve SA's railways

South Africa's railways network - covering freight and passenger services - is set to undergo a transformation if the Minister of Transport Sibusiso Ndebele has his way and transforms a major infrastructure development plan into a reality.

He says that transport in South Africa should no longer be measured in distances but rather in the time it takes to complete a journey, and he is keen to see the times reduced.

"Throughout the world people and goods move with speed and strive to become faster than before," he told the National Council of Provinces when he outlined the plans. And he intends to move the National Transport Master Plan from the realms of idealism into a reality. Already the Cabinet has approved the National Passenger Rail Plan that will secure the future of commuter rail by applying a priority corridor strategy to the network throughout the country.

The rail service will be extended to areas that have previously not been covered and then to improve the efficiency of the existing passenger rail lines. But Ndebele is quick to point out that this is where the first of the funding challenges lie because the rolling stock has to be refurbished and upgraded and new coaches have to be bought.

The R16-billion that has apparently been set aside to achieve this over the next three years is not enough money and Ndebele says more will be required.

"A significant portion of this fund has been committed by the Passenger Rail Agency of South Africa to upgrade more than 2 000 of the 4 600 coaches in service around the country," he says. The delivery of coaches aimed at improving train availability to 96 percent of the current fleet before the end of 2010, so there was an enormous amount of activity at refurbishment sites.

If the December bookings were anything to go by then Ndebele's

goals might be achievable. According to PRASA, the Shosholoza Meyl train services were fully booked for December and Nelson Mphallane, acting head of the organisation, said that there were a record number of bookings for the trains.

The train service operates along 19 scheduled routes and currently carries about 3,2-million passengers a year. Many migrant workers use the train services that stop at 95 stations and operate 1 086 coaches for passengers.

PRASA also operates a luxury rail service known as Premier Classe - introduced in 2001 when it had only four coaches and 24 guests - and now runs a service to Cape Town carrying 126 passengers in luxury.

Passengers are provided with a five course dinner, delicious high tea and there is even a conference centre on board for those travellers who need to do some work while enjoying the luxury of train travel.

So it would seem that PRASA is taking its mandate to improve train travel seriously and has the backing of the Transport Minister to do so.

One of the major problems with train travel in South Africa is that high levels of crime and brutality have marred it — particularly when it comes to commuter services. To overcome this, the Railways Police has been reintroduced and more than 28 000 arrests have been made during the current year, cutting crimes on trains by about 38 percent.

Ndebele says that the South African Police Service has deployed 5 000 members to the rail network and since then has prevented at least 9 000 serious crimes as a result.

The reintroduction of suitable rail services is just part of the overall master plan and Ndebele says that there needs to be a much more realistic balance between road and rail when it comes to moving people and freight.

The Road Infrastructure Strategic Framework for South Africa has identified six critical areas for intervention on the roads network that will serve as catalysts for the future.

The 750 000 kilometres of roads in South Africa are controlled by nine provincial MECs who report to the Minister of Transport and the municipal roads network is the responsibility of the mayors of each local authority.

"Most South Africans don't care who owns the roads they use or who is responsible for them. They want roads that work. However, while we have the capacity to maintain our roads in the developed municipal areas, smaller authorities have limited or no capacity to develop and maintain the roads properly," he says.

The problem facing the transport ministry is that about 80 percent of the roads are older than their 20-year design life. He warns that by the time the damage is visible on the surface, it's too late for quick and effective remedial action.

He says that there needs to be a concerted effort to report roads that are not in suitable condition and then for the responsible authorities to act accordingly to insist that the fundamental engineering maintenance work or remedial action is undertaken at an appropriate time.

Ndebele has blamed poor investment decisions and maintenance cuts that occurred in the 1990s for the poor condition of roads in South Africa and for the nightmare that has seen more freight being moved by road than by rail.

"The downward spiral started when customers switched from rail services to road. Fewer customers meant less revenue on the rail routes, making it impossible to maintain the infrastructure or to continue to invest it.

Apart from the deteriorating roads, the greater use of road transportation and the gradual collapse of railways services, the transport ministry has been facing other difficulties too.

The Road Traffic Management Corporation, mandated to co-ordinate traffic management issues throughout the country, has been dogged with allegations of mismanagement as well.

An investigation into the allegations made against RTMC's chief executive Ranthoko Rakgoale led to his suspension. A task team appointed to conduct the investigation found that irregular expenditure of R144-million had indeed occurred and that an irregular lease agreement of R658-million over a ten year period had been implemented. The lease has subsequently been cancelled resulting in a loss to the corporation of R11-million.

Moreover, based on the recommendations of the task team, several staff at the RTMC have been suspended and a disciplinary inquiry is underway. In addition, a forensic audit is being undertaken and the results will be given to the acting chief executive Collins Letsoalo.

China is not like South Africa – the myth of the New Growth Plan

by Gavin Chait, Whythawk

China's economic growth has been quite astounding. In 1995 the typical Chinese earned $800 a year and was a farmer on a tiny plot in the country-side. At just over $2 a day, the Chinese were only just escaping absolute poverty.

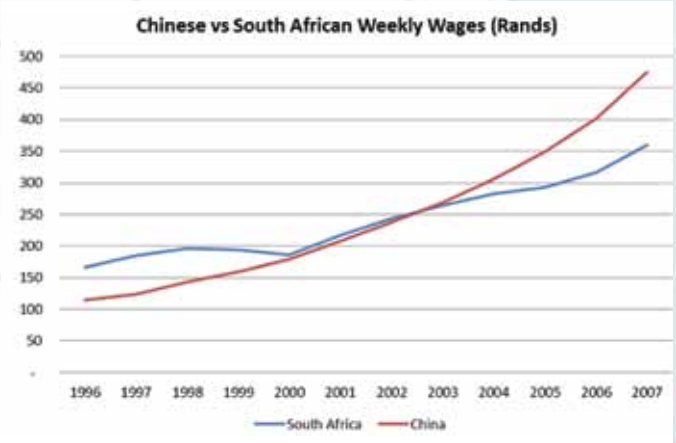
By 2008 the situation was entirely different. Agriculture, from employing 52% of Chinese, only employs 39%. Industry and services now comprise 27.2% and 33.2% of the economy, respectively.

Overall employment has only risen by about 1.0% annually, but the demographic shift has resulted in millions of people moving from rural farms into the cities. And salaries have risen by over 400%; an astonishing 14.2% annual income rise every year since 1995.

The typical Chinese worker now earns $4,400 a year. In South African terms, during the period that Nelson Mandela became the first majority leader in 1994, to Minister of Economic Development, Ebrahim Patel's New Growth Plan, Chinese peasant farmers have become industrial and services workers and seen their personal wages rise from R100 to R560 a week.

Over the same period, the average employed South African saw their weekly wage rise from R166 to R360. In 1995 South Africans were 61% more expensive than Chinese labourers and now, 15 years later, we're 35% cheaper.

Not that South Africa has sat on its hands. GDP is twice the size it was in 1995. It's just that China's is almost seven times bigger.



This wage growth should also be placed in context. Inflation in China has averaged 4.2% since 1994. South Africa's has averaged 10.0% leaving wage earners worse off as their income gains are eroded by increasing prices.

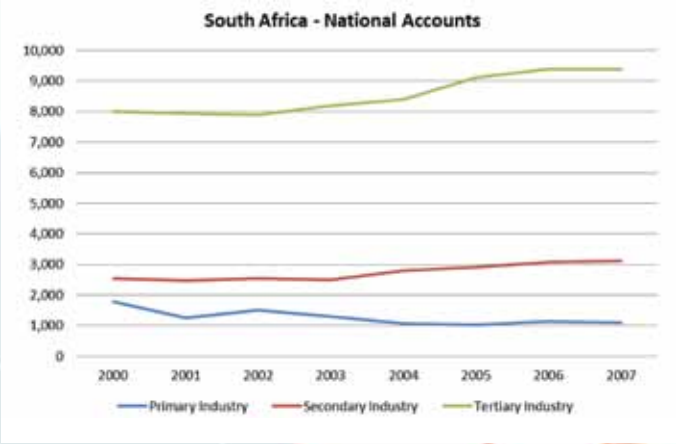
The question is, why is China an economic dynamo while South Africa – even though it has grown – still so laggy? When placed against the phenomenal global growth of the same period (ignoring the economic collapse post 2008) South Africa's experience is quite dreadful.

These questions are not of mere academic importance. Ebrahim Patel's New Growth Plan, dropped with an awful clang in November, is almost homage to the statist policies of the communist autocracy.

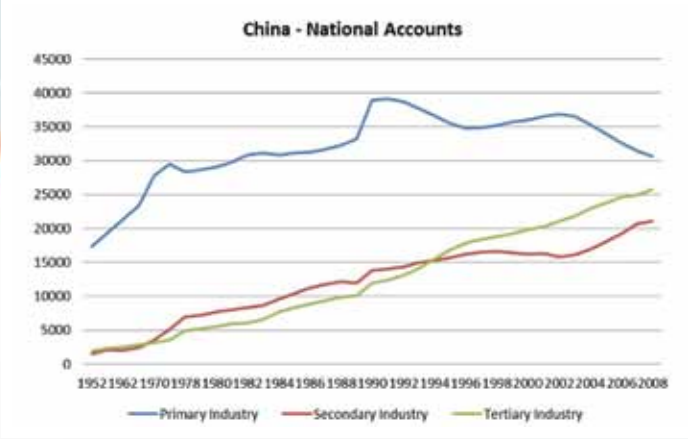
The state will lead growth. The state will set wages for the rich and poor. The state will dictate which industries are the best investments. The state will direct training. The state will create new investment vehicles to support chosen industries. The state.

"Not all of the steps required to secure the necessary employment and growth outcomes can be done by government," says the new Growth Plan. But they're not leaving much place for the private sector.

Yet a very quick look at the structure of the two economies will show just why industrial policy will fail in South Africa.



Source: StatsSA



Source: Chinese Statistical Services

China has gone from being a mostly agricultural society to one which is rapidly industrialising. South Africa kind of skipped that phase. We're a post-industrial society heavily reliant on services for employment but commodity exports to support the economy.

Promoting factory jobs to people who work on microscopic farms is one thing. Promoting those self-same jobs to people who work in retail and services is a little different.

Services businesses are much cheaper to set up than are industrial corporations. The reason for this is that the most expensive components are not big machines but human beings. Their educations and skills are hard won but employers can hire those instead of buying devices. Consider the following table of investment costs for different industries for each job created:

Mining and quarrying industry	R 1,117,641
Manufacturing industry	R 180,898
Electricity, gas and water supply industry	R 2,162,052
Construction industry	R 28,993
Trade industry	R 47,600
Transport industry	R 390,046
Real estate and other business services industry	R 159,471
Community, social and personal services industry	R 14,446

Source: StatsSA

Yet the industries that government wants to promote are not only the most expensive but also the most exposed to industrial action and state regulation.

South Africa is not a barren country incapable of supporting economic growth. We have the world's largest platinum reserves, 80% of its manganese, and the fifth largest gold production. Having valuable things in the ground isn't much of a guarantor of wealth - Nigeria has the world's 10th largest oil reserves - but it does give you something to sell.

The populist response to economic problems is one of protectionism: Industrial Policy. The idea is that select industries should receive favourable treatment through subsidies, tax breaks and levies raised against imports.

In a free market the value of a good would trade at a price reflecting its relative availability. As governments around the world often discover, to mess with this relationship is to invite unpleasant consequences. A good that is too expensive will not sell. A good that is too cheap is unavailable.

With eight million South Africans out of work it is clear that – even though cheaper in relative terms than Chinese workers – they're not cheaper in absolute terms. Part of this has to do with the severe lack of skills that exist. An economy that is heavily balanced towards services and away from agriculture and basic industry is one that requires a relatively highly educated workforce.

It isn't hard to find the root causes for these failings. The World Economic Forum's Global Competitive Index rates South Africa last, out of 133 countries, in maths and science education. We're last in other studies too: the Progress in International Reading and Literacy Study (40th out of 40), and the Trends in International Maths and Science Study (48th out of 48). Yet it's not as if money isn't being spent. 6.1% of GDP goes to education, more than the US (5.7%) or the UK (5.3%) who both do better on league tables.

According to Professor Haroon Bhorat of the Development Policy Research Unit at the University of Cape Town, some 3% of the unemployed (200 000 people) are graduates. Of these 73% are alumni of the Further Education and Training institutes. Most have soft skills that are of little use to the South African economy. However, this – as he goes on to explain – is a red herring. Graduate unemployment is purely a consequence of overall economic growth.

For a given level of growth South Africa does create employment. There is no 'jobless' growth. We just need more growth.

President Jacob Zuma has set a target of creating 500 000 new jobs per year between 2011 and 2020. Hence the sudden proclamation of the New Growth Plan. Consider what that means.

Each 1.0% of employment growth requires 2.3% of economic growth, according to the Third South African Employment Report for UASA. 500 000 jobs a year demands economic growth of 9.0% in 2011 and then averaging 7.6% annually over the next decade.

Such growth requires additional investment of between R60 to R150 billion. Per year. For ten years.

Current foreign direct investment averages only R39 billion a year.

More importantly, in order to support that growth we require appropriate skills. Professor Bhorat indicates that employment is skills-biased. Skilled and semi-skilled employment have grown their share of overall employment by 2% each while the share of unskilled employment declined from 31% to 27%.

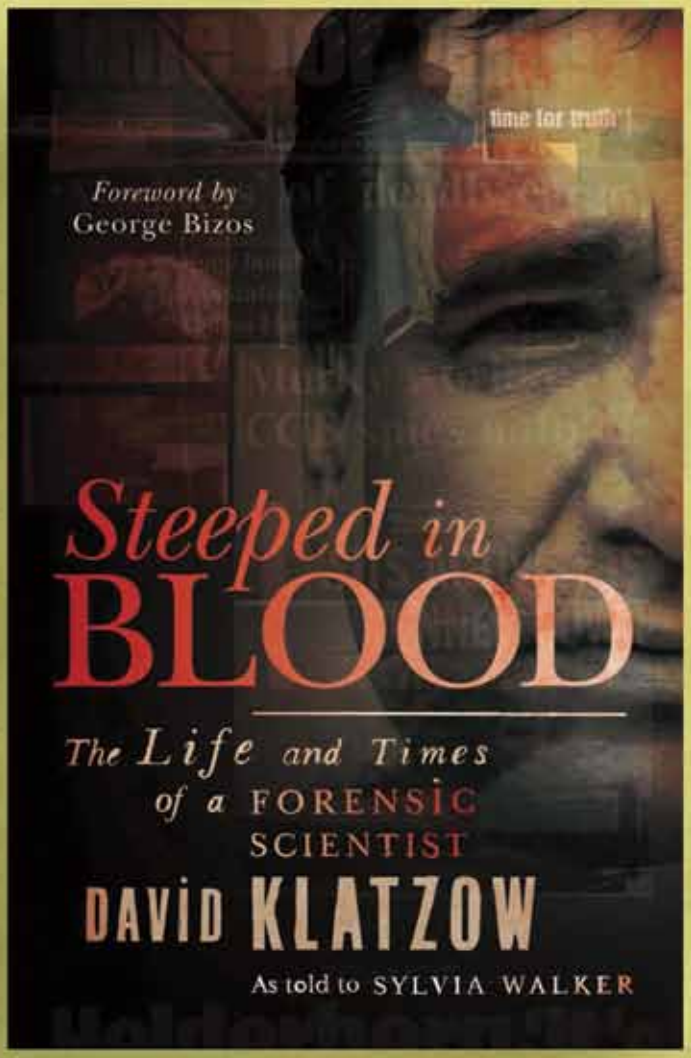
Clearly improving both access and quality of education is essential.

The New Growth Path imagines that 30 000 new engineers will be added to the economy by 2014. This implies that some 10 000 newly qualified engineers must graduate each year from 2012 in order for this to happen. Given that only 25 000 graduate each year at present (from both traditional universities and the universities of technology, previous technikons) it is difficult to see how university capacity can grow by 40% in such a short period.

And, if it were increased, how would the state ensure that these graduates actually stuck around? "South Africa has lost 25% of its graduates to the United States alone. Moreover, South Africans account for 9.7% of all international medical graduates practicing in Canada. Out of all the medical graduates produced by the University of the Witwatersrand in the last 35 years, more than 45% (or 2 000 physicians), have left the country. South Africa's Bureau of Statistics estimates that between one million and 1.6 million people in skilled, professional, and managerial occupations have emigrated since 1994 and that, for every emigrant, 10 unskilled people lose their jobs."

Human Capital Flight: Stratification,Globalization, and the Challenges to Tertiary Education in Africa; Benno J. Ndulu, 2004

Neither has government stated any clear link between additional engineering graduates and direct economic growth. If the economy requires graduates to grow then why concentrate on picking industrial winners instead of supporting overall access and quality of education? The problem with government's industrial policy is that they are



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.

• ISBN: 9781868729227 • Format: Softcover

electing to define what will be the appropriate pathway for economic growth. When governments pick winners then they're declaring that they know the future. They're invariably wrong. And when markets become asymmetrically dominated by one or two firms, which then use that dominance to exclude others, any decisive change in economic drivers will result in tremendous instability since there will be no other businesses to step into the breach. The most obvious example of such instability is Eskom and energy provision. One company provides the bulk of South Africa's supply. It is protected by tariff restrictions and subsidies which limit competitive entry. If Eskom gets their sums wrong then everyone suffers a power failure.

If there were a competitive market for electricity then a failure is mopped up by other companies. Enron, which at one point was the world's biggest energy supplier, failed spectacularly but not a single customer suffered a power outage. The reason a free market will outperform a nationalised economy, is simply one of evolutionary success. Life in general is successful, not because the Earth has consciously chosen a winner and then banned other life-forms, but because every single niche has a life-form. Some aren't particularly successful, but they're still there. So, when conditions suddenly change rather violently, life continues with the previously less successful life-forms taking advantage of changed circumstances, and previously successful life-forms going out of business. You only get one government, so it getting things right or wrong is quite important. In a diversified economy, with a good mix of different types of businesses all competing and held equally to account by symmetric laws, business crashes are not as disabling as government crashes.

What's the answer? How should the government respond to unemployment? By picking economic winners, like the textiles industry, agro-processing and the like and then directing the machine of the state towards those ends?

That's the one that looks presidential and statesmanlike. It's the approach that has form in most countries around the world.

Yet consider again China's success and what it has cost.

China's policy is based on a brave (or foolish, depending on your perspective) strategy. They are paying way too much to protect their local industrial base in the hope that it will be sufficiently sophisticated in time to stand on its own. By keeping their currency and wage levels artificially low the Chinese run a massive trade surplus. This cash is the invisible lubricant that subsidises industry and keeps the whole edifice steaming on.

South Africa could run such a strategy but it requires that wages be held down to boost productivity; the Chinese strategy. If wages are not held down then competitiveness is not possible.

An autocracy can force incomes lower. South Africa's messy left-wing government alliance is never going to adopt such a policy.

China also did not start off by picking winners. That has come later. It could be argued that China used to be much more competitive than it is now. Before, it competed based simply on efficiency. Now it uses every form of anti-competitive policy available to it.

The world has flinched but accepted that China is holding rare earth supply hostage in exchange for increased high-tech capital investment. Could South Africa hold platinum supplies hostage in exchange for industrial investment? Playing industrial policy games is brutal and requires that one has bargaining power.

South Africa is a giant amongst the minnows of Africa and this tends to give us an inflated opinion of our economic standing. Yet Africa is only 2% of global economic activity. A continent that by physical size is almost as large as the rest of the world's landmass, is a statistical blip.

Government can certainly set policy and divide up whatever wealth happens to be present. Nigerian politicians have done a brilliant job of enriching themselves but their country's oil wealth has not resulted in the sort of investment that creates jobs and wealth for everyone. While Patel has the right idea in terms of increasing the number of professional graduates and skilled artisans he needs to place such ambitions in context.

Unless he builds a number of new universities and radically improves the Further Education and Training colleges he cannot increase overall engineering graduation numbers by 30% from 2012. Neither is it useful having such a massive education gap between those who are lucky enough to gain university degrees and those who finish public schools.

It would be as silly as demanding that everyone switch to hydrogen-powered cars but without providing hydrogen filling stations. School leavers need to be more highly skilled when they graduate. Fixing the mistakes of formative education after the fact is expensive and leaves the economy unable to grow. Just as investors looking to build a new factory want to know that sufficient electricity is available they also want to know that a skilled workforce exists. Investment can't happen without the necessary inputs.

We also need to recognise how asymmetric South Africa is. Economic strategies that work for the rich in Sandton may not work in Alexandria. A simple way of recognising this is to scrap company tax for manufacturing businesses physically located inside the municipal boundaries of the most economically depressed places, like Alexandria, Khayelitsha or the whole of the Eastern Cape. If government cannot reduce minimum wages then they're going to have to reduce everything else.

In the meantime an education is a very good investment. A person with a degree in the US can earn, on average, some $500 000 more than a person with only high school over their working life. That includes all the costs of attaining that qualification. Those with professional degrees can earn even more. A good education is invaluable. A bad education is a jail sentence.

Government has wasted the last 15 years. Expecting to create 500 000 jobs a year without the necessary preparation risks getting it wrong all over again.

"There's no magic formula but we need to get the mindsets right ... become a society of self-starters that seize and create opportunities ourselves," said Pravin Gordhan, South Africa's Minister of Finance, answering a question on how to stimulate business and job creation.

Time to take that lesson to heart.

New plan to simulate events on Earth

What has been described as an astonishingly complex computer project is set to get underway and will simulate and model virtually every event that happens on Earth from the spread of infectious diseases to the performance of financial markets.

The project, dubbed the Living Earth Simulator, was devised by a European scientific group and is the social science equivalent of particle accelerators such as the Large Hadron Collider.

Dirk Helbing, professor of sociology at the ETH Zurich Swiss Federal Institute of Technology and chairman of the FuturICT project is now seeking funds to build the simulator.

Apparently thousands of streams of real-world data will be brought together to reveal previously unknown patterns and trends in human society. Dr Helbing claims that many of the world's problems are directly related to human behaviour but, he says, there is a serious lack of understanding about how society and the economy work.

The FuturICT group is seeking $1,3-billion over 10 years from European governments.

Ultimately, Helbing believes, the simulator will be able to help detect impending crises like public health emergencies or instabilities in the financial system while also providing a powerful modelling tool for leaders to test the implications of policy changes in energy, transportation, city planning and so forth.

He admits that much of the technology needed to capture and process the vast data streams needed to drive the simulator has yet to be invented. However, he is quick to point out that many smaller-scale simulations have been undertaken in Europe and claims that vast sums are being spent on developing simulation models.

Dorah and the thrills of navigating a city

The subjects and tasks that scientists will study never cease to amaze me. Take the most recent project from Cambridge University's emotional robotics unit. Its researchers are working on a new navigation device that will "know" when the driver is upset and respond accordingly. So you can imagine a conversation between Dorah The Explorer and a driver.

"In 200 metres, at the intersection, turn left," it starts out.

"Stupid bat," the driver mumbles. "I don't want to do that. It's straight through the centre of town. Are you bats?" he asks.

"Now turn left," says Dorah.

"Get stuffed," says the driver.

"Please make a U-turn at the next available intersection and where it's safe to do so," says an ever-patient Dorah.

"Make me," grumbles the driver.

Emotionally sensitive Dorah kicks in: "We can always go your way if you like. After all you know best. . .".

"Of course I do, I could have told you that," says driver.

"It might take a bit longer but it could be a nice outing today," says Dorah.

Silence for a minute or so.

"If you don't turn soon you'll get lost and you'll be late for your appointment," says Dorah.

"Appointment, what appointment? I'm collecting my daughter you idiot," says Driver.

"It's much longer than the way I wanted to go," says Dorah.

"Oh, shut up," says driver getting increasingly irritated.

"Maybe you'd like a soothing cup of tea," says Dorah caringly.

"Stick you tea where it fits," says Driver.

"If you turn left at the next intersection, I can take over again," says ever-patient, ever-caring Dorah.

Driver accelerates, frustrated but resolute.

"No need to speed up now. Slow and steady wins the race," says Dorah.

He has had it.

Dorah and her device are tossed into the wind. The last thing he hears is the patient voice saying: "Recalculating route. . .".

I'm not sure that an emotionally responsive navigation device is likely to be anymore pacifying than an emotionally responsive wife who's navigating for you.

In fact, I reckon an emotionally responsive Dorah would induce a really bad case of road-rage.

I suppose the scientists will prove me wrong.

Kodak's 3-D printing machine – who cares?

Kodak, the company that made amateur photography a reality and even brought the darkroom into the home for millions of people around the world have now developed a three-dimensional printer for the home market. The problem is that it's not very good.

Kodak admits that the product will have to undergo some significant developments before it is launched into the home market and is so certain that it will undergo various iterations that it hasn't even named the product yet.

The company plans to sell it with two sets of 3-D glasses – distributed in the company's trademark yellow that made its Kodachrome film so famous – and special 3-D processing software and step-by-step instructions necessary to make the prints.

Apparently users will have to take two pictures of the same scene, with the second scene offset by between five and seven centimetres. The processing software will then overlay these two images into one frame so that a 3-D picture can be printed.

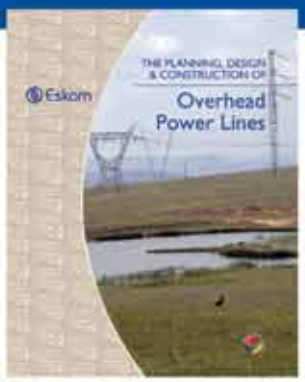
The processing software is available for Windows-based machines only – even though Mac computers are the basis of most image processing throughout the world – and uses the anaglyph process with the 3-D glasses containing a red and cyan filter much like the early 3-D comics used to use.

And the results from Kodak's anaglyph glasses is just as poor as the comics used to be. The image apparently shimmers unpleasantly when it is viewed and rather than creating a truly three-dimensional effect it provides different planes that are flat. The effect is nothing compared with the 3-D television and cinema achievements.

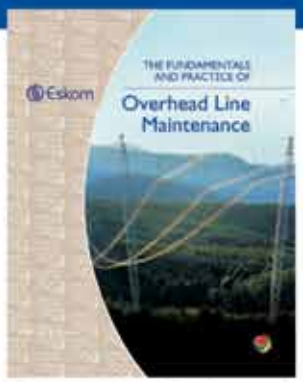
Most of the analysts who have seen the printer, used the software and taken images slightly offset from each other suggest that there is really no value to this development and that very few people will every used 3-D printing for anything.

But Kodak is still very proud of its achievement. Perhaps Kodak will develop a twin-lens camera to capture two images (correctly offset) to print and then process the images in such a way that when you do look at them (with or preferably without) glasses you'll get some true perspective.

Maybe Kodak should stick to photography rather than venturing into the ordinary realm of printing.



Volume 1: The Planning, Design and Construction of Overhead Power Lines



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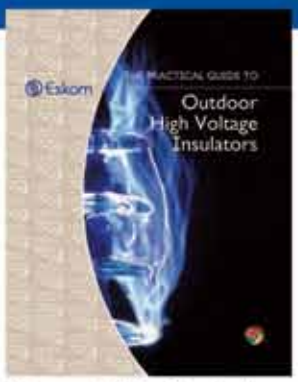

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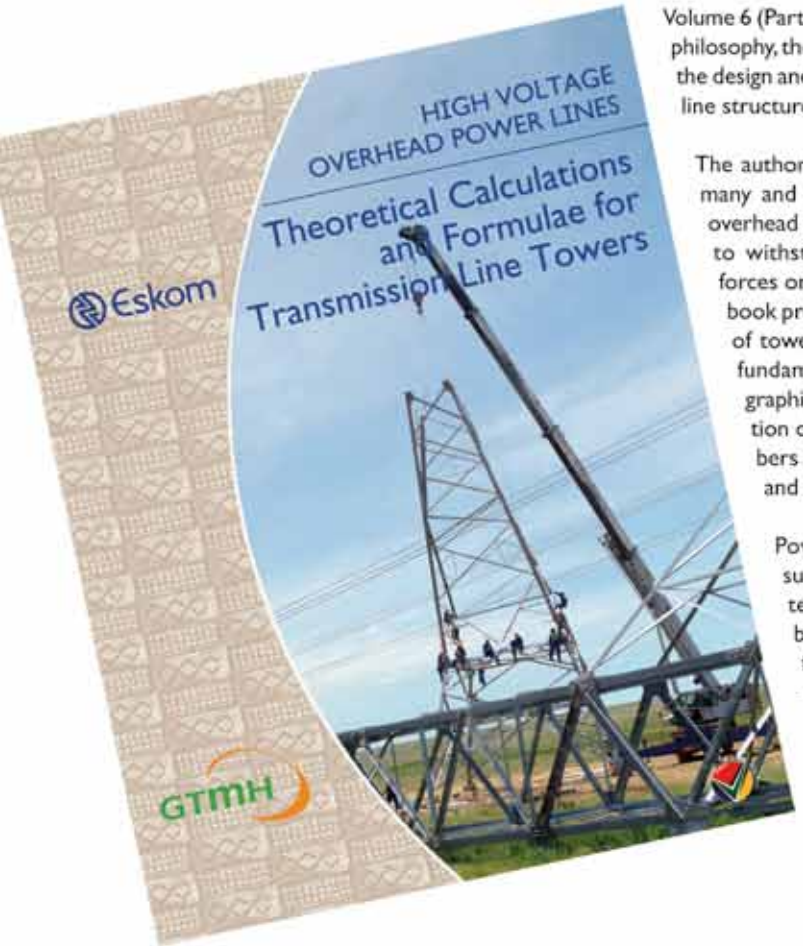
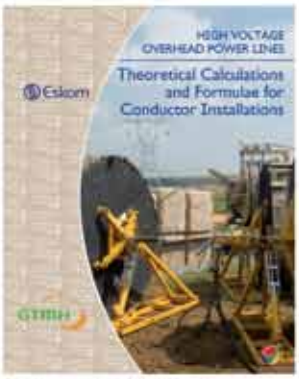


Volume 6 (Part 2) takes the reader through the philosophy, theory, principles and practices of the design and fabrication of overhead power line structures.

The author begins with an analysis of the many and varied mechanical forces that overhead power line towers are required to withstand. Once the nature of the forces on the towers is understood, the book proceeds to discuss the geometry of towers. It moves on to discuss the fundamentals of force diagrams and graphical techniques for the calculation of the forces in the tower members and introduces finite elements and computer methods.

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.

Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers



Volume 6: High Voltage Overhead Power Lines: Theoretical Calculations and Formulae of Conductor Installations

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Eskom

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Dear Paddy,

Compliments of the season and congratulations maintaining a good publication. I was impressed to read in the September 2010 issue about an award introduced by the Council of Engineering and the Built Environment to honour achieving women engineers. It will be nice to have details of criteria of the different categories and the nomination processes. Regards and all the best in 2011.

Prof Nelson Ijumba

Hi Paddy,

Firstly, all Good Wishes to you for the New Year.
The story goes that Einstein was hopeless when it came to mentalaArithmetic and one day, on a bus, a bus conductor had to give him a very simple step-by-step explanation regarding the payment for his ticket. Afterwards, Einstein apologised for being so stupid.

The conductor replied: "Don't worry old chap, we can't all be Einstein's."

So now I don't feel quite so bad in what I would like explained to me, in simple bus-conductor-language-and-patience how an electric hybrid car will work.

In the article Hybrids, Electric Cars Tested (WATTnow November 2010) it states:

1: The vehicle needs about seven hours to charge, using a 240 volt wall socket.

2: It consumes 34 kiloWatt hours for every 100 miles travelled.

To me this seems completely wrong.

The maximum amount of electrical power that can be taken from a power socket outlet is only 3 kiloWatts, any more than this, and its circuit breaker goes into orbit.

To replace 34 kW/h of electrical energy, therefore, this would take an absolute minimum of (34 divided by 3 =) 11.33 hours. (Given paper, pencil and a calculator, I think even Einstein would agree with me on this point) and this does not allow for electrical losses that would shove it up even further to about 13 or 14 hours.

The manufacturers of the car therefore appear to be nearly 100 percent out in their estimated recharging time.

I would not be happy with the idea of having to wait 14 hours (even 7 hours, come to that) to replace the electrical energy used to travel a measly 100 miles. No doubt the manufacturers would come up with the excuse that power is replaced while travelling using 'dynamic braking' or similar.

Notice too, that I haven't even commented on the fact that I could be paying an additional R5,000 or so, a year for the luxury of owning such a car!!.

I would be keen to hear what any other engineers might have to say about this.

Howard Davies, Pr. Eng

Hi Paddy

I read an article by you recently in WattNow where the discussion went around the small number of engineers being produced by South African universities and the relations between the number of engineers vs technicians vs artisans and so on.

I agree wholeheartedly with the sentiments in the article.

However while reading it, I was thinking about what a farce the whole issue of CPD has, in my opinion, become. The motives behind CPD are as usual excellent. But the mechanics have become impractical.

I am a registered professional engineer of many years standing, having registered in 1988 and maintained it since. I have never left engineering and continue to work in the area of telecommunications and power telecommunications. I continually work to develop my own skills, I mentor others and so on. I know I am a Professional Engineer, and deliver work to match.

What irritates me about the CPD process is the proliferation of expensive courses, requiring time off work and large expenditure (especially if the employer doesn't pay) to complete. Attendance of such courses is mandatory really if you want to collect the necessary points to be able to extend registration.

At this moment in my life I have decided to allow my professional registration to expire when renewal comes around again simply because I cannot be bothered to pay the sums required and take time off to renew a status which has delivered no value to me over the years.

As a telecommunications engineer employed by many companies, I have not needed an explicit registration to be able to work, and my quality of work and professionalism reflect that I am, indeed, a professional engineer. I do not need the ECSA certification of the fact.

I will of course continue to mentor and assist young engineers, and produce quality work, but without the expense and hassle associated with professional registration.

As I said, it seems to offer no value, it is not tax deductible, my employer won't pay it, and I do not need it to practice.

I would appreciate your publishing this letter for comment as I am sure I am not alone in thinking this way. It is of course a sad thing for South Africa to have a declining professional engineer population, but to me, sadder still that part of the reason may be the well-intentioned CPD program.

Regards
Don Andrews
SAIEE Member

Cycling and the lead acid battery

The roots of lead acid battery technology date back to work by Planté in 1860, over 150 years ago, and in spite of feverish activity to find alternatives for electric, hybrid and fuel cell vehicles, it remains the dominant vehicle battery technology by a long, long way. Peter Middleton, led by Louis Denner, MD of First National Battery, takes a perception-changing tour of the company's battery museum in Benoni to unravel the reasons for different cycling capabilities and the continued pre-eminence of lead acid technology.

A few months ago, I began to dabble with solar cells. Relatively cheap photovoltaic panels are appearing in more and more hardware stores and although their power output remains low, it seems well matched to that of compact fluorescent light bulbs. So, I thought, why not try to link up a few panels to a string of outside lights. I get to play and we can sit out at night feeling self-righteous. I am not delusional though, this is a toy and adults shouldn't spend too much money on toys. I procured a redundant and faulty UPS from work and I went off to my toy store where I bought three 10 W solar panels (R480), eight CFLs (R240) and a 'TV battery' (R375). It wasn't difficult to mount the panels on my roof, connect them to the battery and replace the UPS's pathetic little battery with my new 25 Ah TV version. The lights go on, but not for long.

In every article you ever read about photovoltaic systems, you will be warned that 'you must use a deep-cycle' battery. Any battery of the appropriate voltage will work, but only deep-cycle batteries will last. My 'TV battery', while carefully avoiding the direct 'deep-cycle' claim, was advertised as 'suitable for solar use'. Car batteries, while looking identical, are described as shallow-cycle and if looking at any battery web-site, you will also get other battery options, for the likes of golf buggies, for example.

Then a piece about the Raylite Ultimate battery caught my eye. This battery, with 'advanced AGM technology: immobilises the acid in the battery; delivers an extra high starting current; is more vibration resistant; and especially suitable for deep cycle applications.' And hence my visit to Raylite's manufacturer, First National Battery to see Louis Denner, to unbundle the meaning of battery cycling and the reasons for such a wide variety of different battery types.

First National Battery is a 100% South African company owned by Metair investments, which is listed on the JSE. It has been making lead acid batteries in East London since 1931, manufactures automotive batteries for all seven local OEMs, and for the aftermarket, and a wide range of batteries for industrial applications.

The Benoni premises is a recycling facility. "The lead acid battery is the most recycleable product in South Africa, better than glass bottles or tins," says Denner. Scrap batteries are collected and processed for lead and polypropylene, which is shipped back down to East London for manufacturing new batteries. "We are currently producing in excess of 2-million car batteries per year and a vast number of different industrial batteries on top of that," Denner adds.

For the replacement market, First National Battery sells though the Battery Centre franchise network consisting of 115 distribution centres, the largest non-food franchise in South Africa.

Denner highlights some of the company's niche industrial developments: "We are one of the biggest mine cap lamp producer in the world, having produced over 4,5-million cap lamps since 1982," he claims. The newest versions use a completely sealed valve regulated 4,0 Ah lead acid battery coupled with 1,5 W. state-of-the art LED lights. They lamp gives 16 hours of light before needing to be recharged. This compares to the 16 Ah batteries that used to be required for incandescent equivalents – and the new versions are brighter.

In the corner of the museum, he takes me to a 48 cell traction battery purpose built to power underground electric locomotives. . "These are very durable, guaranteed for four years and 1 250 charging cycles. All horizontal movement in the mines is done with this type of battery," says Denner. On a 24 hour shift, they will use three sets of these batteries, one on the loco, and one on charge and one cooling down after charging.

Forklift batteries with automatic electrolyte top-up systems, batteries for starting diesel locomotives, train lighting batteries and traction batteries for golf buggies, the only imported product, all feature. He shows me a backup power system with four 64 Ah batteries powering a lighting system. "The batteries are charged from mains but, if there is a power cut, the backup system automatically comes on. These systems are designed for a 25-year life and are typical of what you might find at power stations," Denner says. "Power stations all need big UPS systems and we supply all Eskom installations: We are also currently involved in a system for the refurbishment of a nuclear plant." A battery-based back-up system can also be found in every cell phone tower and Telkom installation.

Turning our attention to lead acid battery technology, Denner says that all lead acid batteries work in the same way. When fully charged, they all have lead dioxide (PbO_2)

on the positive plates and metallic lead (Pb) on the negative. When discharging, ie, delivering current, the (sulphuric) acid changes the material on both sets of plates to lead sulphate (PbSO4), while the acid changes to water.

A key feature of the technology is that the lead compounds are insoluble. They stay attached to the plates and there is never any significant amount of lead in solution. The other reaction products (water and sulphuric acid) are completely soluble. These properties are an important part of why the lead acid cell is so wonderfully rechargeable.

The plates for lead acid batteries are manufactured on a lead metal grid, for structural support for the pasted active material and to collect the current and channel it out though the grid lug. For a simple two-plate cell, a separator is inserted in between the plates to prevent them from touching and to make the battery compact. "If you now covered this cell with acid, you would have a basic unformed battery, with active material paste – a mixture of lead oxide and lead sulphates – on the grids of both plates," Denner tells me.

On 1st charging, which Denner calls forming, the negative plate is electrically converted to lead and the positive to lead dioxide. This cell would give you 2,1 V and possibly 5,0 Ah. "So for a 100 Ah battery, you would place 20 sets of plates in parallel," he explains – so for all my ex science teachers, please note, there is nothing 'single' about a car battery's 'cell'. To get a 12 V, or a 12,6 V battery you need to place six of these cells in series.

Denner describes how a battery is rated. The C20 capacity is the 20 hour discharge capacity measured in ampere hours (Ah), so an 80 Ah battery will be fully discharged after delivering 4,0 A for 20 hours – at 25°C and its 'discharged' voltage is below 10,50V. This is the general or nominal battery capacity. But chemically, a fully discharged, or completely flat battery will read 11,5 V or less on a volt meter. The C20 capacity is directly affected by the amount of active material and acid used in the batteries. "You can get a good sense of this by simply weighing the battery," suggests Denner.

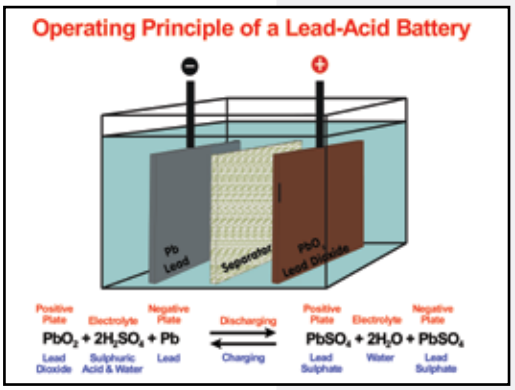
A second specification is the Cold Cranking Amperage (CCA). This is determined by total surface area of the opposing plate surfaces of all of the active plates, so a high CCA is achieved by putting a lot of plates in parallel in each cell. A high CCA battery might deliver 800 A when cooled to -18° C. A third specification is the reserve capacity, usually given in minutes, eg, how long can you draw 25 A from this battery before it goes flat. Historically, according to Denner, the specification tells you how long you could drive without a fan belt before your ignition system would fail.

But none of these specifications really tell you much about cycling. "The thicker the positive plate, the longer the battery will live," adds Denner, and cycling, ie, the number of charge and recharge cycles and the depth of discharge of each cycle, directly determines battery life.

As you discharge a lead acid battery, lead sulphate accumulate on the sets of plates. The plates therefore gradually grow thicker. Car batteries need to deliver high-current for a very short period of time, but once started, they immediately begin to recharge and the maximum depth of discharge is seldom more than 3%. A low depth of discharge forms very thin layers of lead sulphate and these are quickly removed on recharging. But if you use a car battery for a solar application, you completely discharge the battery and thicker layers of lead sulphate accumulate. Repetitive charge and discharge cycling causes the positive active material to gradually shed from the positive plates

This shedding, causes the material which falls off the plates to accumulate, uselessly, at bottom of the battery. This material is no longer in electrical contact, can no longer

Louis Denner, MD of First National Battery.



The operating principle of all lead-acid batteries is, in principle, identical. When fully charged, the active materials are lead dioxide on the positive plate and lead on the negative. Both plates are converted to lead sulfate on discharging.

First National Battery is the biggest producer of mine cap lamp in the world, having produced over 4,5-million since 1982.

A 48 cell traction battery purpose built to power underground electric locomotives.

CPD Overview

WATTnow, in conjunction with the South African Institute of Electrical Engineers (SAIEE), has launched this programme for engineers who need to meet their professional development commitment by securing Continuing Professional Development (CPD) credits. In terms of the renewal of registration requirements, all professional electrical engineers must earn five CPD credits a year. Failure to certify CPD credits could jeopardise renewal of their registration.

WATTnow publishes articles in each issue that qualify readers for Category One CPD credits, which require engineers to respond to in-depth questions posed on articles that are specially designed and validated to provide CPD. Engineers using the system will accumulate between 0.1 and 0.3 CPD credits if all the questions are answered correctly. Ten such articles are published annually so at least one CPD credit can be obtained by this method. The articles in **WATTnow** are independently validated by the SAIEE, which determines the exact value of each credit applicable to each issue of the magazine.

In future, **WATTnow** will produce a series of video broadcasts of up to six lectures annually on topics that have been validated for CPD by the SAIEE. These lectures will be filmed and edited by a **WATTnow** production team and converted to either CD or DVD disks before being distributed free-of-charge to members of the **WATTnow** CPD Programme.

A series of appropriate questions will be included on the CD or DVD and members of the programme can submit their answers directly to **WATTnow** by e-mail, on-line or by fax. The filmed presentation will qualify the user to claim credits in the Category One section, which makes attendance of a conference at least once a year mandatory.

The SAIEE will issue each member with an official certificate recording the exact number of credits gained by each individual in any given year.

The **WATTnow** CPD Programme is based on a subscription service that will cost non-members of the SAIEE R2 400 a year while members of the institute will pay an annual subscription fee of R1 000.

This programme offers all members of the **WATTnow** CPD Programme a one-stop-shop to participate in and comply with the professional development criteria laid down by ECSA and ensure that all professional engineers can maintain their status without having to search around for sufficient credits to meet the ECSA requirements.

For further information visit www.wattnow.co.za

be reconverted when charging and therefore, its loss directly results in a loss of battery capacity. Because of shedding, a traditional car battery will be completely dead after 50 or 60 such full discharge cycles, less than two months on a daily solar cycle.

So how do you improve a battery's ability to cycle? You prevent shedding by ensuring that the positive active material (lead dioxide) is kept in good contact with the positive grid. "The simplest way is to add a glass mat layer that acts as retainer and prevents shedding," says Denner showing me a battery that looks exactly like my TV battery. It even has the same green charged/discharged indicator window. 'Suitable for cycling duty' is written across the top instead of 'suitable for solar applications'. The additional glass mat, which looks like tea-bag material, is forced onto the outside of the active material on the plates during manufacture, which makes it harder for accumulated material to fall off. The process is called double separation and can more than double the number of charge and discharge cycles compared to normal car batteries. So my TV battery is actually good for at least 120 cycles of operation. Perhaps I should only switch the lights on once a week.

Then Denner takes me over to the Rolls Royce of lead acid batteries, deep cycle batteries that are actually designed to be charged and discharged every day. "For these batteries, we change the positive plate." Instead of using a grid as the starting point, we cast a row of spines connected to a common bus at the top. Each spine is then enclosed by its own individual tube, sealed at the bottom and filled with active material. This is called tubular positive plate technology. "By having all the active material enclosed in a tube, the material cannot fall off during cycling and is permanently retained in electrical contact," he explains. First National Battery guaranteed their deep cycle batteries for 1 250 cycles based on an 80% depth of discharge at 25˚C.

"So for solar use, I can give you a car battery that will work for 60 days. I can give you a slightly better battery with a glass mat retainer that will last for twice that long, or I can give you the real McCoy," Denner tells me.

And the Raylite Ultimate? This is a car battery, but usually car batteries are not designed for cycling at all. But there is an increasing need for batteries that can cope with the start-stop technology now beginning to be incorporated as an efficiency feature on modern cars – the engine automatically switches off when the car comes to a standstill and restarts automatically when the accelerator pedal is depressed.

The Raylite Ultimate has a self sealing valve to prevent excess pressure build-up and is therefore generally known as a valve regulated lead acid (VRLA) battery. These batteries are not 'flood-filled' with acid as most are. Instead they use a special absorbent glass mat (AGM) which acts as both the carrier of the electrolyte and the separator. They therefore never need topping up.

Also, in a flooded battery, the acid level comes over the plates but under the straps. Because the acid in an AGM battery is immobilised, the plates can be higher, giving 19% better crankability per unit volume.

Most importantly, though, the battery is built under high compression, 25 kPa, so as to tightly hold the AGM in contact with the plates. This results in both a higher power density and better cycling characteristics, because the pressure counters the shedding tendency so they can give you up to 450 full discharge cycles.

"So if you are in any doubt about whether the battery you are buying can cycle, you should ask some questions. What kind of separation is being used, micro-porous polyethylene or glass mat sheets; if the battery is a flooded battery or a VRLA battery built under compression; or does it have tubular positive plates? These features define the cycling capabilities of all lead acid batteries," suggests Denner.

I intend to use his advice to extend the life and capacity of my solar lighting system in the very near future.

Deep cycle batteries are designed to be charged and discharged every day. To prevent shedding of active material, the positive plates are constructed with a row of spines each enclosed by their own individual tube.

The Raylite Ultimate is a valve regulated lead acid (VRLA) battery that uses absorbent glass mat (AGM). The battery is built under high compression, 25 kPa, to hold the AGM in contact with the plates and prevent shedding. The result is both a higher power density and better cycling characteristics.

Left: Part of a backup battery built in 1939 and used at Cleveland Power Station. Right: A sample of First National Batteries historical car batteries.

Back: A 1961 8,0 V deep-battery designed for farm lighting. Front: a Weston calibration cell from 1952.

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Youngest supernova discoverer

A Canadian girl aged just ten has been recognised as the youngest person ever to discover a supernova or exploding star according to the Royal Astronomical Society of Canada.

Kathryn Aurora Gray of Fredericton in New Brunswick was combing dozens of telescopic images of star fields in faraway galaxies when she spotted Supernova 2010lt in the constellation of Camelopardalis in a galaxy 240 light-years from Earth.

Gray told her father, Paul – an amateur astronomer – about what she had seen and her observations were later confirmed and verified by two United States amateur astronomers before being reported to the International Astronomical Union's Central Bureau for Astronomical Telegrams.

Supernovae are huge stars that run out of fuel and then collapse under the weight of their own gravity to become an ultra-dense object known as a neutron star.

The collapse sends out a shock wave that rips the star apart, leaving a sizzling cauldron of radiation.

These events are among the most awe-inspiring phenomena witnessed by astronomers and are detected when the high-energy explosion creates a dramatic flare that eventually fades away.

Neanderthals, Denisovans and Humans

An ancient cousin of modern-day humans once shared the Earth with Neanderthals and this relatively has now been positively identified by scientists using DNA taken from a 30 000 year old finger bone of a young girl.

The child's DNA shows it was neither human nor Neanderthal and was from a previously unknown species now called Denisovan. The bone and a tooth fragment was discovered in the Denisova cave in southern Siberia.

Researchers claim that like Neanderthals, Denisovans interbred with early humans and traces of their DNA can be found in modern-day Melanesians – the people who live in the islands around Papua New Guinea. Vanuatu, New Caledonia and the Solomon Islands.

They are genetically distinct from Polynesians.

Scientists believe that the Denisovans occupied much of the land across Asia but became extinct alongside the Neanderthals as early humans thrived.

The bone was discovered by Russian researchers in 2008 and was examined by a team of specialists from the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany.

They compared the Denisovan genome sequence with that of the Neanderthal and with modern humans. Denisovans were a sister group to Neanderthals and descended from the same ancestors who split from the ancestors of modern humans.

Scientists have known for some years that Neanderthals and early humans interbred because there are traces of Neanderthal DNA in non-African humans. Now they have found that Denisovans also interbred with humans and traces of their genes are found in modern-day Maleanesian.

The team of researchers compared the Denisovan DNA to the genetic code of 38 present-day humans from 53 populations. More than five percent of the DNA of two ethnic Melanesians matched the sequences from the Denisova girl.

According to Professor Richard Green of the University of California in Santa Cruz, the human story gets more complicated. He says that instead of the clean line of modern humans migrating from Africa and replacing Neanderthals, there are now other lines and interactions that previously had not been known.

He says the Denisovans were quite different genetically and morphologically from Neanderthals and modern humans, with the tooth similar to those of older human ancestors such as the homo erectus.

Green says that evidence now suggests that an ancestral group of early humans left Africa up to 400 000 years ago and diverged, with one branch heading into Europe and becoming Neanderthals and a second moving further east and becoming Denisovans.

When modern humans left Africa about 80 000 years ago, they came into contact with Neanderthals and another group met – and interbred – with the Denisovans resulting in the traces which exist in the Melanesian population.

For years scientists have speculated that several different species of human lived side-by-side at various times over the past one million years and that many lived in tropical zones where bones are not easily preserved.

The most recent report adds to the evidence that there may have been other modern-looking species that have yet to be discovered.

Radical detergent to clean our air

Levels of a naturally occurring substance that acts as a kind of detergent in the atmosphere are high than previously thought according to a new study undertaken by researchers at the National Oceanic and Atmospheric Administration (NOAA) based in Colorado.

The substance, known as the hydroxyl radical, is formed in the atmosphere when ultraviolet light from the sun reacts with gases in the atmosphere, causing an atom of oxygen to link with an atom of hydrogen.

The resulting substance is so chemically reactive that it disappears in less than a second by combining with another compound, often a pollutant, initiating a breakdown of that pollutant into simpler, less dangerous chemicals.

Given the short lifespan and low abundance of the hydroxyl radical, scientists have battled to measure it on a global scale. Indirect measurements indicated that the level varied by as much as 25 percent a year, and it was this finding that created some uncertainty about managing pollutants.

The finding also undermined confidence in the computer analyses because the computer models kept suggesting that the levels of hydroxyl should be relatively steady. The theories embedded in the computer models seemed to conflict with the real-world data. Now, lead researcher at the NOAA, Stephen Montzka says the computers were probably right. He and his team have devised a better approach and while the measurements are still indirect, they are based on the on-going breakdown of a pollutant that phased out in the 1990s.

The results show much less variability in hydroxyl levels than in the previous studies.

The scientists have stopped short of saying hydroxyl levels never vary but they have found that over a decade, the variability is very small.

They claim that Mother Nature is supplying a relatively steady dose of the hydroxyl detergent to clean up the mess that the human race keeps inflicting on the atmosphere.

Montzka says that assuming the results of their experiments withstand critical scrutiny then government departments like the Environmental Protection Agency will have more confidence in their ability to predict the fate of pollutants in the atmosphere.

However, Montzka does warn that carbon dioxide is not one of the gases affected by the hydroxyl radical.

Moreover, the results do not suggest that pollutants like oxides of nitrogen and sulphur will be completely cleansed as these are growing rapidly and even if nature is able to remove some pollutants, its cleansing process is limited compared with the quantity of oxides being released into the air.

Political views – a choice or a consequence?

Right-wing political conservatives have different brain shapes from their left-wing liberal counterparts according to a recent study conducted by neuroscientists at the University College of London. Scans of 90 students at the college showed that self-proclaimed right-wingers had a more pronounced amygdala, a primitive part of the brain associated with emotion, while their political opponents from the opposite side of the spectrum had thicker anterior cingulates. Professor Geraint Rees, director of the UCL's Institute for Cognitive Neuroscience, conducted the research. He was apparently surprised by his own findings.

Actor Colin Firth who was guest-editing the BBC Radio 4's Today programme commissioned the project as a light-hearted experiment to discover whether we are genetically programmed with a particular political view.

His suggestions has now developed into a serious scientific work.

Professor Rees says the anterior cingulate is a part of the brain that is on the middle surface at the front. His work showed that he thickness of the grey matter, where the nerve cells of neurons are, were thicker in people who described themselves as liberal or left-wing and thinner in those that described themselves as conservative or right-wing. "The amygdala is a part of the brain which is very old and very ancient and thought to be very primitive and is thought to be used for the detection of emotions. The right amygdala was larger in those people who described themselves as conservative," he says.

"The findings are very significant because they suggest there is something about political attitudes that are either encoded in our brain structure through our experience of that our brain structure in some way determines or results in our political attitudes," he says.

I wonder what a brain-scan of Julius Malema might show?

Rats can help to detect TB by smelling us

Researchers at the Western Michigan University use the Gambian pouched rat to detect traces of tuberculosis in an individual. Traditionally, test rely on collecting a sample of sputum and then analysing it in a device that costs $17 000 using cartridges that costs $17 each.

The sputum is dyed with a substance that colours Mycobacterium tuberculosis – the germ that causes TB – strain that can be seen under a microscope. Unless there is a high concentration of bacilli, these can easily be missed.

However, the Gambian pouched rat does much better than that. The omnivorous rodent with puffy cheeks is able to smell the difference between tuberculosis bacilli and the many other germs that inhabit human phlegm.

According to lead researcher, Alan Poling, the rodents are being used as a "reasonable" diagnostic tool in Tanzania but the First World medical community have so far not accepted the method.

Dr Poling and his colleagues tested the rats' reactions to samples of phlegm that had been confirmed as being positive or negative by laboratory results. The rats were able to detect the presence of tuberculosis 86,6 percent of the time and they could detect the absence of the germ with 93 percent accuracy. In another test, the results from the rats were compared with those from observations under a microscope and the rats correctly identified 44 percent more positive cases than the person assessing the microscopic sample.

The rats are raised in captivity and are all descended from rodents captured in the Uluguru Mountains in Tanzania or on the outskirts of Morogoro, a city in the highlands comprising about 200 000 people.

Apart from its work detecting tuberculosis, the Gambian pouched rat has other uses and is the same species (Cricetomys gambianus) that is trained to sniff out land mines because it is light enough not to set them off.

The rats start their training when they are eight weeks old. The process rewards a rat for spending at least five seconds with a positive sample but gives them nothing for a negative sample.

This apparently teaches the rat to quickly assess different sputum samples and react accordingly by loitering for a few moments or just quickly moving on.

Plastic Pacific island claims debunked

A huge island formed from plastic debris floating around in the Pacific Ocean is actually not nearly as large as originally claimed when initial reports said it was about twice the size of Texas.

The floating plastic island was apparently said to contain more plastic than plankton and had been growing tenfold each decade since the 1950s. These reports have also been debunked.

The plastic island is not even visible from the deck of a passing ship according to the latest analysis from Angelicque White, a professor of oceanography at the Oregon State University.

She took part in a recent marine expedition to examine the mass of plastic that is floating in the ocean and while the extent of the plastic island was nowhere near as large as reports had suggested, White found that plastic does represent a real threat for the oceans.

She says that genuine scientific concerns are undermined by the scare tactics of others who make ludicrous and unsubstantiated claims.

"The amount of plastic in the world's oceans is troubling but this kind of exaggeration undermines the credibility of scientists doing serious work in this field," she says.

White points out that the plastic island – reported as being about 1,3-million square kilometres in size – is actually just a fraction of that and while plastic stretches across the surface of the ocean, its mass compared with the amount of water means it takes up a fraction of the proclaimed area.

She says that while plastic may be toxic to some marine life, it actually helps to absorb other toxins and there is even evidence that some organisms are breeding on the plastic debris.

White says it would be prohibitively costly to remove the plastic debris and the main focus now should be on preventing more trash from fouling the world's oceans.

Her findings are supported by the research done by scientists at the Woods Hole Oceanographic Institution that found, at least in the Atlantic Ocean, that the amount of plastic in the sea has not increased since the mid-1980s.


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Magical mystery tour – of a nuclear plant

Iran has invited the ambassadors of Russia, China and several countries within the European Union, to inspect its nuclear sites but has stopped short of asking the United States, Britain, France or Germany to join the group.

The US State Department spokesman Philip Crowley accused Iran of orchestrating a "magical mystery tour" that is deliberately aimed at disguising the country's real nuclear programme. Talks between Iran and the P5-plus-1 group, led by Baroness Ashton, the European Union's foreign affairs representative are due to resume in Istanbul in February. Other countries include Egypt, Cuba and Hungary.

Iranian government spokesman, Ramin Mehmanparast says that the invitation is a goodwill gesture by the government that will take ambassadors to the uranium enrichment facility near the city of Nantanz and to its heavy water facility at Arak to demonstrate that the country's nuclear activities are peaceful and co-operative.

Iran has not indicated if it will show the visitors anything other than those facilities that are currently open to inspection by the International Atomic Energy Agency.

Iran has consistently insisted that its nuclear programme is being developed for peaceful purposes but Western critics say the way the projects have been set up are a clear indication that Iran intends building a nuclear weapon.

Indian rocket blown to smithereens

An Indian space rocket carrying a communications satellite exploded moments after it lifted off from its launchpad at the Sriharikota space centre in Andhar Pradesh state.

The failure of the mission is seen as a setback for India's commercial space business.

The Geosynchronous Satellite Launch Vehicle (GSLV) exploded in the first stage of the flight leaving a large trail of smoke and fire in the sky. The initial launch of the GSAT-5P satellite had been delayed because of an engine defect.

According to K Radhakrishnan, head of the Indian Space Research Organisation, the rocket performed as expected for the first 50 seconds of the flight but then developed a "large altitude error" and blew up. He says that researchers will have to study the flight data before reaching any conclusions.

India is hoping to expand its satellite launch business to about $120-million a year, just 25 percent of China's existing launch business.

In April last year another Indian rocket, designed to lift heavy payloads using a domestically-built cryogenic engine, malfunctioned and plunged into the Bay of Bengal off India's east coast.

In 2008 India successfully sent 10 smaller satellites into orbit using a single rocket and also dispatched its first unmanned flight to the Moon.

The Moon mission was abandoned 10 months later after data recording evidence of ice had successfully been sent back to Earth.

India is planning its first manned space flight for 2016 – so there will have to be some rapid improvements in its launch techniques over the next five years.

Christmas trees becoming a breeding ground for fish

Discarded Christmas trees are being used as habitats for fish in barren lakes in North America.

The trees are collected by volunteers, bundled together and secured and then dropped onto the lake's bed where the branches get covered with algae, attracting aquatic insects, then fish and finally fishermen.

According to Pete Alexander, fisheries programme manager for the East Bay Regional Park District in Oakland, California, the trees are a perfect breeding ground for fish. According to the Census of Horticultural Specialities, compiled by the US Department of Agriculture, wholesalers sell about 12-million Christmas trees a year and are left with as much as ten percent of their inventory after Christmas. "That's about a million trees that have to be disposed of and the fisheries programmes are an excellent way to do so," says Alexander.

Most retailers turn the surplus Christmas trees into mulch or wood chips and in New Orleans, leftover Christmas trees have even been used to restore parts of the coastline damaged by Hurricane Katrina.

But Alexander says that aquatic habitat projects are becoming a popular solution for getting rid of unwanted Christmas trees. The bundled trees last for about five years under the water. "The GPS co-ordinates of each bundle of trees are meticulously recorded and only those volunteers who assist with bundling the trees together and dropping them into the lakes are given those co-ordinates. That way they can go and fish there and be relatively sure of getting a decent catch each time they venture out," says Alexander.

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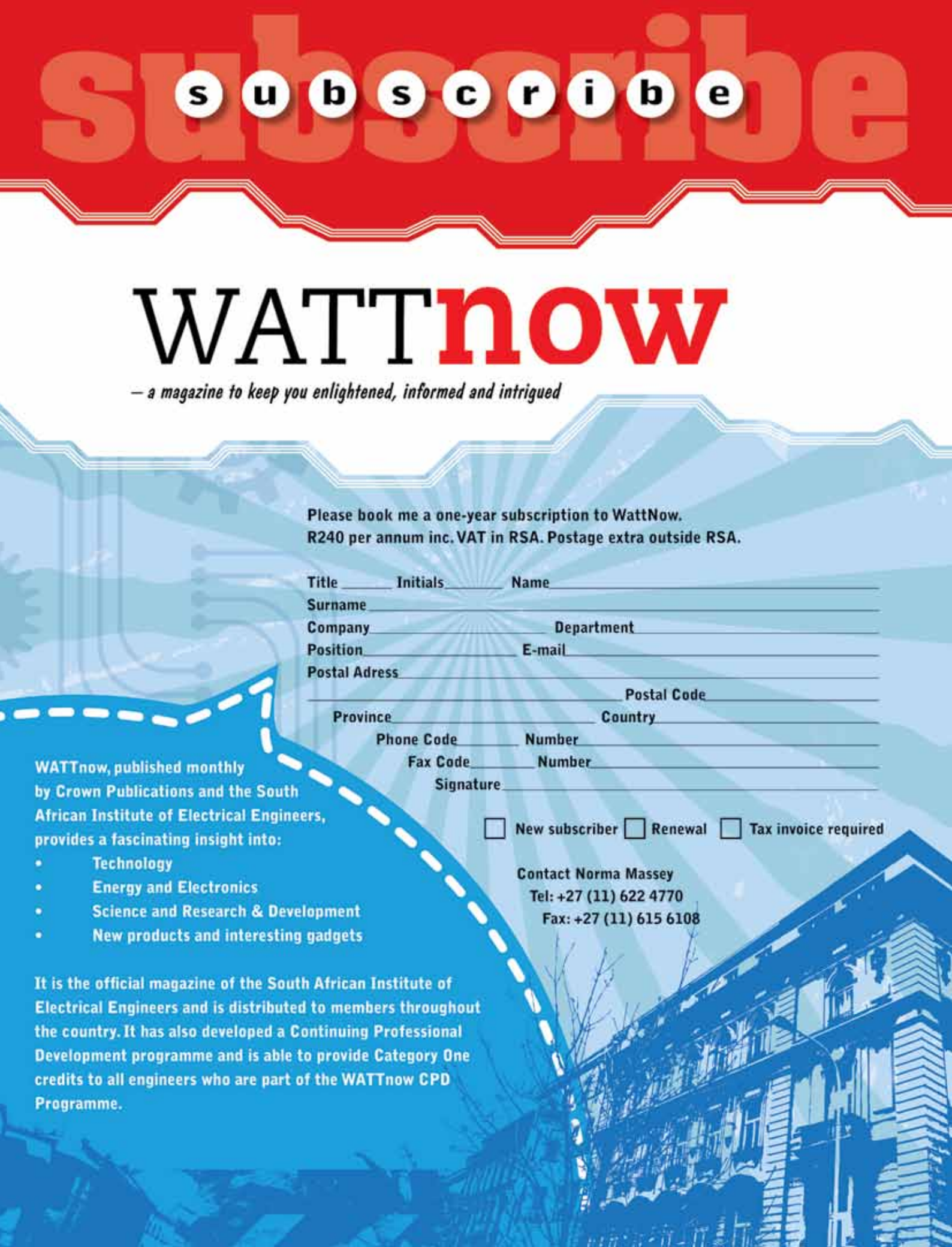
WATTnow, published monthly by Crown Publications and the South African Institute of Electrical Engineers, provides a fascinating insight into:

- **Technology**
- **Energy and Electronics**
- **Science and Research & Development**
- **New products and interesting gadgets**

It is the official magazine of the South African Institute of Electrical Engineers and is distributed to members throughout the country. It has also developed a Continuing Professional Development programme and is able to provide Category One credits to all engineers who are part of the WATTnow CPD Programme.



Local authorities ban use of smart meters

The Marin County Board, a small local authority in the northern San Francisco Bay area has criminalised the installation of smart meters because they are a public nuisance. The law affects all 70 000 residents.

Among other things the board cited electromagnetic health risks, concerns about the meters being used to collect personal information about residents' activities, interference with amateur radio networks for banning smart meters.

Pacific Gas & Electric, commissioned its contractor, Wellington Energy to complete the installation by the end of this year to comply with a state mandate to install smart meters throughout southern California.

However PG&E dismissed one of its executives late last year after he admitted to using smart meters to monitor what the company's competitors were doing.

Several other towns, including Fairfax and Watsonville have also passed laws banning the use of smart meters.

PG&E says the smart meters allow for faster power-outage detection, daily and hourly summaries of energy use and alerts to owners when the use of energy will lead to a higher pricing tariff.

Frequency regulation vital for stable electricity supply

Frequency regulation in electricity supplies is as critical as voltage control or generating capacity but it is not something that most customers would notice until something goes catastrophically wrong according to an American company AES Energy Storage.

The company has opened a plant in Johnson City, New York State that fine-tunes the electricity grid to keep supply and demand in balance.

In North America, the grid is supposed to run at 60 cycles, meaning that the electrons change direction 60 times each second. In practice, if the electricity supply and demand are not perfectly matched at every instant the system runs a little bit too fast or a bit too slow.

If that pace strays too far from the 60-cycles-per second, equipment like pumps and motors will either run too fast or too slow causing cut-off switches to be activated, shutting down these motors or pumps automatically to prevent damage.

It was this sharp decline in frequency that contributed to the huge blackout that swept across North America in August 2003.

AES Energy Storage says that traditionally electricity utilities maintain the balance on a gross level by adding or subtracting generation and then fine tune it by running the turbines used to generate electricity at a slightly faster or slower pace. The steam turbines typically used in coal-fired power stations have a great deal of inertia so they can deliver large amounts of energy promptly but with the switch to gas turbines, this inertia is less and so the frequency control has declined.

The problems are even more acute with wind generators, which tap the breeze and cannot maintain the kind of consistent frequency required for a stable electricity grid.

AES Energy Storage has resolved this problem using batteries and computers and is now selling its frequency regulation systems around the world. It absorbs or delivers energy at intervals of five seconds as ordered by a computer that runs the New York State grid.

AES Energy Storage uses thousands of lithium-ion batteries to supply or absorb the current promptly because the batteries have the ability to change direction easily.

John Zahurancik, vice president of operations and deployment at AES says that batteries are a lot better than turbines because they do not need to be revved up – like engines – because batteries respond equally well whether absorbing or delivering current.

The AES project was developed using a federal loan of $17,1-million, equivalent to about 80 percent of the cost of building the plant. It will eventually be able to absorb or deliver about 20 MW of power for a period of up to 15 minutes although Zahurancik says that the system is typically making much smaller adjustments in each direction using smaller amounts of power for shorter durations.

He says the technology could eventually be used to store energy for use at different times of the day.

For instance wind energy could be captured at night and then delivered to consumers during the day when electricity prices tend to be higher.

Zahurancik says the AES project will eventually use about 800 000 batteries, each roughly the size of a D-cell and enclosed inside several 16-metre shipping containers.

Message from the president

In the first few months of its second century, the South African Institute of Electrical Engineers has been more active than ever in serving our members, the engineering profession and the broader society. As always, we remain dedicated to promoting electrical science and its applications for your benefit.

In addition to focusing our various activities on this year's theme, Engineering the Future, we have made substantial progress on engineering the future of the Institute itself. At the start of the term of the 2010/11 Council, we set a number of goals for the year:

* Complete the restructuring of the SAIEE and hire key staff
* Make SAIEE Publications into an operational company
* Construct a new headquarters building for the SAIEE
* Establish new website, online presence and social networking
* Establish Student Chapters affiliated to all Centres
* Extend educational outreach initiatives to all Centres
* Run at least six events per Centre and per Section, and two major events

I am pleased to report that we have made good progress on most of these goals, and have plans in place for the remainder.

The Restructuring Committee, chaired by Ian McKechnie, Past President, completed its final recommendation to Council in August, and approval was given to proceed with implementation. The restructuring includes a number of committee, operational and staff changes, as well as amendments to the constitution, which will be shared with all members in due course. A number of the committee and operational changes are already being implemented.

One of the immediate changes has been the establishment of an Education and Training Committee, chaired by Dr Nhlanhla Mbuli, to drive our various educational initiatives, including bursaries, competitions, student chapters and outreach to schools. More than ever, we need to promote the interest of young people in our profession, and we will be increasing these activities in future.

A business plan has been developed for the SAIEE Publications company, and is being put to the company's board and the SAIEE as shareholder for approval, after which we will proceed with making the company operational. The 2011 budget for the SAIEE has been developed in conjunction with the budget for the Publications company, to enable us to continue to grow our publications, a key part of the service we provide.

The Council agreed in May to proceed with the construction of our new headquarters building, adjacent to Innes House on the historic Observatory site. A budget of R12m was approved, and a Building Committee established to oversee the project, chaired by Paul van Niekerk, Vice President. A professional team has been appointed, construction has commenced, and we aim to lay a foundation stone early in 2011.

Those who have seen our presence on LinkedIN and Facebook will know that we've taken the first steps towards broadening our online presence. A sub-committee of the Publications Committee, under the guidance of Larry Khuvutlu, has made substantial progress of the specification for our a new SAIEE web portal, which will be implemented during 2011.

Following my visit to the various Centres around the country earlier this year, it became clear that we need to provide greater support to the volunteers who run these Centres, and we will certainly be doing so through the restructuring. A workshop was held in early November with all Centre chairs, which has established a basis for better communication and co-operation between the Centres and our head office.

With regard to events, we have had a very active year, with the Power Section Committee, chaired by Silas Moloko, and the Electronics and Software Section Committee, chaired by Peter Tolsma, each running a number of events, with more to come. The sections have also been active in providing articles for our monthly magazine, WATTnow. Most Centres have also had active event programmes for the year.

We have had very positive feedback from members following the Bernard Price Memorial Lecture by Dr Glenn Ricart, which was presented in Jo'burg, Durban, Cape Town and Port Elizabeth. In addressing "The past and future of the Internet", Dr Ricart not only gave a fascinating insight into the development of the Internet, but also provided some thought-provoking ideas in line with the SAIEE's theme for the year, "Engineering the Future". Earlier this year, the President's Invitation Lecture by Kobus Meiring of Optimal Energy, on the topic of electric vehicles, similarly resonated with the theme, and was well received.

Thank you to our full-time staff, who have worked particularly hard this year under great pressure, and to all the volunteers on Council and our various committees and the Office Bearers of the Institute. Finally, I would like to wish all SAIEE members and their families well over the festive season and for the new year.

Dr Angus Hay, President
angus@saiee.org.za, Tel: +27 11 585 0490

A New Era in Technical Training for Eskom – Distribution

By Sanjian Malapermal: Senior engineer – industry association resource centre at Eskom

In the last two decades, Eskom Distribution has seen many changes, changes that continually drive business improvement and business efficiency. As the demand for increased efficiencies grow, so to, does the demand on the skills base of the business increase. Skills development has been at the forefront of major companies in South Africa and Eskom – Distribution is no different.

With ever increasing pressures on Eskom to retain engineering staff, training and skills development becomes a serious challenge to sustain the longevity of the African giant. Regional Distributors have experienced high staff turnovers, with critical, core and scarce skills being identified in the Distribution Network Planning sections.

This has highlighted the need for concentrated distribution industry training in a multi-delivery approach. This need has led to the development of a network planning training framework that identifies the principles of the training, which in turn initiated a research funded project to develop and role out a technical training programme for the distribution network planners on an e-Learning platform.

To ensure insure that all these challenges were met head on, IARC has selected Sanjian Malapermal, to head up the programme. Sanjian Malapermal, a Senior Engineer driving technology development within the Power Plant section of IARC. He is well experienced and knowledgeable in Distribution Network Planning and has led the development of this technical training programme.

The Industry Association Resource Centre (IARC), positioned under the Sustainability and Innovation Department within the Corporate Services Division of Eskom Holdings Limited is committed to supporting the technology needs of the Distribution Division and the Electrical Supply Industry at large. This is made possible by a team of industry experienced resources that collectively have myriad years of experience, knowledge and skill to provide technology support and development to the Eskom Distribution Division.

The network planning technology development team, positioned in the Power Plant section of IARC is responsible for technology development and standardization for the more than one-hundred and forty (140) Eskom Distribution network planners.

The gap in the ability to deliver effective "training on demand" has introduced the need to develop a "Blended Learning" solution as depicted in figure 1 below. Blended Learning incorporates the most efficient and effective combinations of learning delivery methods. From traditional classroom based learning to the modern e-Learning or web based learning that can be accessed via a Learning Management System (LMS) such as the MyLearning system currently in use by Eskom. The intention of the online training is to skill the newly appointed network planning engineers to a competence level required to effectively perform their job function. e-Learning is a relatively new concept in engineering within the Eskom Distribution Network Planning environment. The system allows an individual, "the prospective learner" to log onto the LMS and to either self enrol or are pre-enrolled for a specific course within the distribution network planning environment. Ten courses that make up the training programme have been completed and ready for implementation in 2011, two additional courses will be added in the 2011/12 financial year. Conventional classroom initiatives are planned to succeed the e-Learning sessions. This is to ensure that all learners are at a minimum acceptable level of understanding of the content before attending the conventional class room. Virtual classrooms are a vital part of the blended learning model but are not planned for in this initiative. The intension of the virtual classroom is to aid the refresher learning process by allowing new content to be added to the program to support technology advancements and development. These virtual classrooms will enable the support of industry case studies; video and pod casts, audio visual material that will be delivered on demand to the learners registered on the LMS.

In order to assist the learner and to create a logical flow to the courseware, from an instructional design perspective, the course is modularized to enable learning in modular sections. The training program covers the contents of each of the standards and guidelines for Network Planning under the Technical Steering Committee of Distribution (TESCOD).

The Training Programme consists of the following courses.

- The planning methodology
- The Distribution planning standard
- Geographical-based load forecasting
- Network reliability
- Medium voltage underground cables
- Medium Voltage step regulators
- Shunt Capacitor banks
- Lines and Cables
- Transformers
- Power Quality
- Technology Phasing and selection*
- Voltage regulation and apportionment limit*

*** Courses to be released in 2011/2012 financial year**

The future vision of the technical training program includes courses on:

- Project / Financial evaluation of project
- Network Planning and electric motors
- Project Prioritization for Network Planners

- Embedded generation
- Network asset cost of supply methodology

Regional mentors that represent workgroups in each of the learning areas are present in each of the regions to support the learners through the e-Learning process and subject matter experts will support the instructor led training.

The above technical training programme represents the first of its kind in the Distribution business and makes available training material on demand.

The Distribution Network Planner's, literally have their future at their finger tips.

With the cost of technical training increasing each year as the demand increases, Eskom Distribution now have and affordable internal technical training program to support the continuing professional development of their engineers. This programme has been in principle, accredited for continuing professional development (cpd) credits by the South African Institute for Electrical Engineers. One credit under category one (Developmental Activities) will be awarded for the e-learning component and depending on the duration of the face-2-face sessions, being either two or three days long, one credit will be accredited to each day of the course.

The support and partnership of the SAIEE with IARC on behalf of Eskom Distribution has been admirable. There can be no doubt that this programme with set the bar for the future of training under the very challenging circumstances.

For more information contact Sanjian.Malapermal@Eskom.co.za

George's Ultra-Filtration Plant

A group of members from the SAIEE's Southern Cape centre visited the George Municipality's Outeniqua sewage and waterworks near Pacaltsdorp to view the ultra-filtration plant and new return pipeline system that has been built and commissioned there. Jan Brink from SSI Engineers and Environmental Consultants started off by explaining the layout and workings of the plant in various different stages as well as the different various processes involved. This was followed by a tour of the whole plant for viewing and further explanation. Members were able to view pumps, storage tanks, the special ultra-filter assemblies and the plant control system. See pictures below:

Aeration dams.

Spiral pumps lifting water to be aeration dams.

Ultra filter skid – three skids installed side by side.

Management and control system being explained.

Storage tanks – ceramic coated steel panels.

Part of the group, with filter installation behind them.

TELECOMMUNICATIONS RESEARCH GROUP

POWER LINE COMMUNICATIONS:
University of Johannesburg

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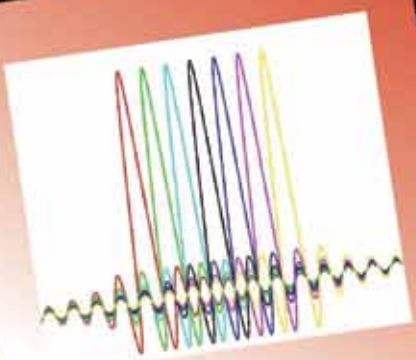

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