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Be Enlightened

Will high **electricity** prices sink the economy?

10-billion-trillion places **to live**

OBE - a student bemoans the education system

Official Magazine of



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April 2009

Penalties are not the answer

The penalty tariffs being proposed by the National Energy Regulator of South Africa (Nersa) – presumably endorsed by government behind the scenes – are draconian and may even be deeply damaging to the South African economy in the longer term.

I cannot see how, in Nersa's eyes, economic growth can exist alongside measures that are aimed directly at inhibiting that economic growth. Forgive my short-sighted and simplistic view: but if manufacturers, industrial companies and mines want to increase production, and thus increase economic growth, they need energy – in the form of electricity predominantly – to do so.

Take away the energy and you stifle economic growth. Provide the energy and you stimulate economic growth. That's surely not hard to grasp.

I do think that some companies in South Africa – certainly households, retailers and building landlords – may well be guilty of wasting electricity on an enormous scale. Just look at how the various shopping centres, in all the South African metropolitan areas, are left lit up like a Christmas tree for weekends on end, and you'll have a true scale of the wastage.

But I don't think the same can be said for industry, mining or, for that matter, agriculture either.

To impose measures that could force industry, mining and agriculture to pay a penalty of up to R9 per kilowatt hour is surely like using a jackboot to squash an ant. I would far rather see greater incentives being provided to industries, mines and farmers to encourage them to improve electricity consumption by using technologies that are readily available in other parts of the world.

In my view, Nersa could use incentives that would give direct, tangible incentives to manufacturers for deploying or investing in smart grids, automated electricity controls, variable speed motors and the like. These technologies not only reduce electricity consumption but provide sustainable benefits in the longer term.

Penalties simply inhibit or prevent economic growth and job creation.

Of course Nersa says that it will provide some incentives to industry but it has not provided any details on what those incentives might be. Instead it has come up with a far-fetched plan that pushes up costs, cuts future investment and destroys confidence by using penalties as a weapon to reduce electricity consumption. I mean R9 per kw/h is a huge penalty for anyone to pay.

As we should all know by now, incentives are better than penalties at getting companies to comply with planned and necessary reductions in electricity consumption. The most obvious tool is to provide some kind of tax rebate on investments in energy efficient technologies. There are many, many more of these types of incentives that could be used.

But has Nersa devoted any of its own energy to finding these kind of solutions.

Apparently not.

Throughout the world, governments have proven, time and time again that incentives create positive long-term benefits while penalties simply encourage people to find ways to beat the system. In a worst case scenario, this could mean relocating their manufacturing businesses out of South Africa and setting them up in a place where electricity supplies are constant but penalties are non-existent.

You might think that this is a far-fetched notion but I've already heard reports of companies investigating longer term opportunities in countries such as Mozambique and Botswana where the electricity supplies, in the long run anyway, are likely to be more reliable and certainly a lot cheaper than energy costs in South Africa over the next ten years or so.

Obviously mines are not in the same position. These operations must, instead, rely on energy-saving measures such as using new technologies or possibly resorting to generating their own electricity, using renewable energy resources.

I suppose it is still a bit early to tell what the final penalties will be, considering that further public hearings will have to take place before Nersa can make its rulings,. But I still believe that using the 'big stick' of financial penalties is not in the long-term national interests of South Africa.

Primarily because while we need to save electricity, we also need to stimulate our economy and to do so we must have affordable energy resources.



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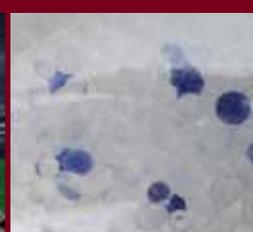
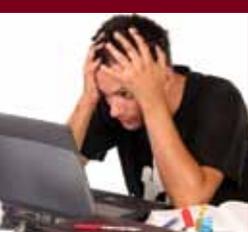
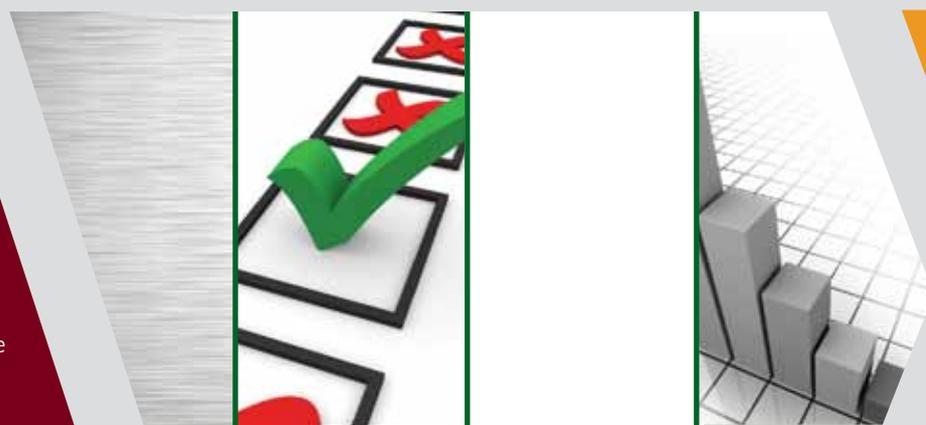
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New regulator for SA standards and specifications

South Africa now has a National Regulator for Compulsory Specifications (NRCS), which will administer the compulsory specifications throughout the country, along with the technical regulations that are aimed at protecting consumers and the environment while promoting free competition in the economy.

Until now a division of the South African Bureau of Standards was responsible for monitoring compulsory and technical regulations. The establishment of the NRCS forms part of the Department of Trade and Industry's strategy to modernise the country's technical infrastructure resources.

The NRCS will be responsible for approvals, inspections and market surveillance as well as for imposing sanctions at appropriate levels to deter abuse of the regulations. Currently, the compulsory regulations cover

food and allied products, vehicle, tyres and vehicle components, electrical products and components, building and construction materials, cleaning and sanitation materials, personal protective equipment, firearms and shooting ranges and plastic bags.

According to Trade and Industry Minister, Mandisi Mphahla, the NRCS would conduct market surveillance by inspecting products from manufacturers, importers, distributors and retailers to ensure that consumers are protected and the legal requirements pertaining to those products have been met.

Apparently the NRCS will conduct technical training courses for its staff and for businesses involved in the installation, maintenance, verification and calibration of measuring instruments. Mphahla says that should any product not comply

with the regulations, it will be taken off the market by the NRCS.



Catalytic converter production down

Local production of catalytic converters accounts for about 14 percent of the world market and exports of converters generated sales worth R18,3-billion in 2007. Kuehn says that most of the 35 motor manufacturing companies around the world have already implemented shorter production weeks for the staff.

In South Africa, the local catalytic converter industry has seen more than 1 000 jobs being lost and Kuehn expects further job losses this year. The industry has called on the government to provide some protection to manufacturers in a bid to halt job losses, but in terms of the new Automotive Production and Development Programme, this industry will no longer be supported by government.

Kuehn says that one of the major problems

facing catalytic converter manufacturers is that they are a long way from the motor manufacturing plants in Europe, America and Asia and he says that the government needs to provide incentives to manufacturers here to ensure that the industry remains viable.

The catalytic converter manufacturers represent the largest beneficiation industry for platinum group metals in South Africa.

The Department of Trade and Industry has apparently promised to provide some clarity on the new Automotive and Production Development Programme, to the catalytic converter manufacturers within the next few months.

The new programme replaces the existing Motor Industry Development Programme, which comes to an end in 2012.



South Africa saw its production of catalytic converters for the international automotive market drop by 45 percent in the last quarter of 2008 according to Hans Kuehn, chairman of the Catalytic Converter Interest Group. He says this is an indication of how seriously the global economic crisis is affecting the local and international automotive industry.

Pneudrive competition for 2009 gets underway

A competition to stimulate interest in mechatronic innovation is being held for eight South African universities, and students participating in the competition stand to win an all-expenses-paid trip to Germany, along with products worth R100 000 for their university.

The competition, sponsored by SEW Eurodrive and Festo, requires students in their third or fourth year, to design a product handling application, using pick-and-place technology, that is capable of moving products between five and 15 metres.

Industries where these applications are usually found include the food and beverage sector, packaging, warehousing, bulk materials handling, timber, sugar and tobacco industries. Elements such as speed, positioning, accuracy, acceleration and deceleration, repeatability and cycle time will be taken into account when judging the entries.

Students are encouraged to include energy efficiency in their designs and must provide energy efficiency calculations in the submissions. The design must use a combination of SEW Eurodrive and Festo products.

According to SEW Eurodrive's marketing manager, Rene Rose, the success of last year's competition prompted the companies to once again sponsor this event, although some of the rules were changed in consultation with the participating universities.

"Last year we found that students battled to select a project and spent a lot of time devising plans for possible applications. In the end, a dart-throwing machine was the winning entry. So this year we have insisted that students design a pick-and-place application for any one of the many different industries that rely on these innovative systems," says Rose.

She says that the project parameters are sufficiently broad to incorporate a wide number of different applications and the innovation of students will certainly be a key component in judging the winning entries.

"We have also included the option of earning bonus points for

students who use specific products made by the two companies," says Rose. "For instance, if an electric cylinder or a proportional valve is used in the design, this will earn one bonus point. A second bonus point can be earned by the groups that provide proof of successfully connecting, programming, operating and testing the machines."

SEW Eurodrive and Festo have supplied a range of products to students at the eight universities that can be used to actually build the machines.

All submissions for this competition must be in an electronic format and must include a comprehensive and detailed presentation that covers a description of the design, a list of products used, the rationale for the design and any unique features it may possess, a project management plan, an energy efficiency report and a detailed budget proposal.

"We have set down these details because, in the real world, these are the issues that an engineer will have to incorporate in a proposal to management or an executive committee," says Rose.

"At university, students spend an enormous amount of time learning about theory and less time on the actual practical work undertaken by a qualified engineer. This does not necessarily prepare students for the work that they will do when they are employed by a company and must come up with a practical solution to everyday problems," says Rose.

The competition closes in June and the winners will be announced in August.

The eight universities taking part in the competition are:

- University of the Witwatersrand
- University of Pretoria
- University of KwaZulu-Natal
- University of the North West
- Nelson Mandela Metropolitan University
- Cape Peninsula University of Technology
- Stellenbosch University
- University of Johannesburg.



Gerhard Strydom from Festo addresses students on the use of the software program that allows them to accurately choose the correct product for a particular application.



Students at the University of Pretoria listen attentively to the rules of the Pneudrive Challenge Competition 2009, which closes in June this year with winners being announced in August.



Research company rat

Siemens Southern Africa has been rated as the sixth best company to work for in southern Africa according to the results of the CRF Best Employers survey for 2008/09. This annual research project is designed to assist high-performing organisations with an overall assessment of the human resources functions.

According to Samantha Crous, publishing manager of the report, the over-arching aim of the Best Employers survey is to identify, accredit and laud South African companies that have a demonstrable commitment to, and track record in, talent management best practice.

Crous says that employee engagement should be a fundamental part of a company's overall brand and international research conducted by Gallup showed that employee engagement can be a catalyst for change and transformation. It is good for the business in terms of employee retention, increased productivity, effective service delivery, greater profitability, increased customer engagement and greater safety.

Referring to a report by Robinson, Perryman and Hayday, Crous said those employees that are actively engaged with the company they work for showed the following behaviour patterns:

- A belief in the organisation
- A desire to contribute to making things better
- An understanding of the business context in which they work
- Are respectful and helpful to their colleagues
- Are willing to 'go the extra mile'
- Keep up to date with developments that might affect the company itself.

For the survey, CRF looked at the following criteria:

- Organisational strategy with regard to talent management priorities
- The overall human resources function and its alignment with the business strategy
- The leadership and its active involvement in talent management as a driver of employee engagement
- Communication between employees and the company
- How the company is responding to the diversity imperatives, such as broad-based Black economic empowerment
- Training and development of employees to ensure they are nurtured,

mentored and developed in a way that allows the individual to reach his or her goals

- Performance management and the competency framework for assessments
- Rewards and recognition for employees who are achieving successes.

At the end of the research phase, the results are audited by Grant Thornton and a rating report, based on the human resources benchmark survey, is compiled. This rating is compared with the information from the individual companies participating in the survey.

If any anomalies, concerns or possible errors in the information are found then the company is contacted by the CRF researchers to ensure that the information they have is, in fact, correct or, whether it needs to be amended.

In terms of Siemens Southern Africa, the CRF report points out that the company's slogan, excellence through advanced recruitment sums up its approach to attracting talent and its internal practices are considered to be an industry benchmark. The report states that Siemens has been recognised for implementing best practices for four consecutive years.

Group human resources services manager, Nicolette Barnard says that the success of Siemens' approach to recruitment lies in the application of advanced methodologies with vacancies advertised both internally and externally, and preference being given to existing employees.

Screen techniques are used to ensure that individuals are suitable for the immediate position and to assess their potential for future succession plans. She says that each individual is measured against certain capabilities such as entrepreneurial spirit, determination and strategic judgment. Qualities such as energy, the ability to take the initiative, and learn and embrace change, are also taken into account.

Barnard says the employees must have the analytical and business skills to execute a task correctly and must have a passion based on customer-centricity and professional ethics. Competency-based panel interviews are supplemented by targeted simulations to accurately assess job-related skills.



es best SA companies

In 2007 Siemens launched its Skills Revolution Project in order to enhance the attractiveness of the company and strengthen its proposition as an employer of choice. Staff turnover has remained comparatively low at 14 percent and Siemens aims to reduce this to eight percent.

Personal development at Siemens follows a process that is used throughout the world and aims to set targets for employees, identify skills gaps and work to close these gaps in a systematic manner. At all levels there is apparently a high degree of employee engagement with managers being invited to give their opinions on an individual's performance or ability to take on greater levels of responsibility.

In terms of remuneration, Siemens works on a total reward package that is market related. However, the addition of a range of incentives and benefits means that compensation is actually well above the industry average. The Incentive Package Scheme rewards individuals who meet targets related to business objectives and the scheme is based on the employee's level and position in the company.

Where warranted, project bonuses are provided. There are also various retention schemes that include additional pay for managers, or those people who have exceptional talents or scarce skills.

In addition to providing mentoring and coaching for its employees, Siemens provides excellent technical training and spends about R30-million on skills development each year. The company offers financial, engineering and training bursaries and has implemented its own apprenticeship scheme that will see 100 artisans being trained over the next three years.

An information technology learnership programme is also in place.

The company places a great deal of emphasis on what it calls the work-life balance and has created an outdoor Trim Park, with golf driving nets, a running track and outdoor exercise equipment and has also provided wide-area-network-enabled work stations.

Siemens provides parenting courses for its employees, has refurbished its restaurant – which offers three meals a day – and will soon introduce a dry-cleaning service, car wash facilities and discounted membership at an off-site gymnasium. All employees are given free medical examinations each year.

In terms of its Black Economic Empowerment track-record, two empowerment groups, Sekunjalo and Africom each acquired a 13 percent stake in the company in 2001 and 2002 and this has now grown to a level of 30 percent for the two groups. It has an empowerDEX rating of BBB, making it a level five contributor.

In terms of employment more than 30 percent of management and more than 50 percent of total staff come from previously disadvantaged backgrounds and, in the past year, nearly 70 percent of the new recruits are black. About 41 percent of the company's R1-billion procurement spend is directed towards black-owned and black-supplied companies.

In South Africa Siemens employs 2 600 people and its sales amounted to about R9-billion last year. It operates in the electrical and electronic engineering sector.

Siemens was originally established in Berlin in 1847 under the name of Siemens & Halske Telegraph Construction and, at the time, specialised in electric telegraphs. Today the company employs 35 000 researchers around the world, files 8 000 invention reports annually and holds more than 50 700 active patents. The company operates in 190 countries and employs just over 400 000 people throughout the world.

In South Africa, Siemens' roots go back to 1860 when the company installed the first telegraph line between Cape Town and Simon's Town. It has its southern African headquarters in Midrand, with branches in Cape Town, Pinetown and Port Elizabeth and manufacturing locations in various parts of Gauteng.

In recent times, Siemens has consolidated its complex and diverse areas of operation into three sectors:

- Healthcare, energy and industry;
- Power generation, transmission and distribution technology;
- Industrial products and services.

According to the CRF report, the combination of these factors makes Siemens one of the Top Ten employers in the country and is certainly a place that many South Africans would love to work – provided that they have the skills, the abilities, the commitment and the passion and are prepared to work hard too.



Coal and electricity

– an inextricable link for more than 100 years

In South Africa, coal and electricity production are inextricably linked and have been since the earliest power stations were built in this country. Shortly after the discovery of gold on the Witwatersrand it quickly became evident that large stamp batteries were needed to crush the ore and extract the wealthy seams of gold in the rock.

Soon enough, steam engines were used to drive the stamp batteries but there were simply not enough supplies of indigenous wood to keep these batteries running. Fortunately, South Africa was not only blessed with magnificent diamond resources in Kimberley, gold on the Witwatersrand and in parts of the Eastern Transvaal lowveld (now Mpumalanga) but extensive coal reserves throughout the land.

Extensive coal deposits had been found in the Eastern Cape, Kwa-Zulu Natal as well as in the old Transvaal in areas known today as the Mpumalanga, Gauteng and Limpopo provinces. The problem with the coal fields was that they were far away from the gold fields of the Witwatersrand, making it extremely expensive to transport coal to the city of Johannesburg where mining activity was almost frenetic.

Fortunately for businessman, Sammy Marks, a gentleman named George Stow who had found what he thought was a major coal field at the confluence of the Taaibosch Spruit and the Vaal River close to where the town of Parys actually stands today. Stow was disappointed with his finding – he was actually looking for gold like most of the other prospectors – and even the old Free State government was not interested in getting him to prospect for them so they cancelled his contract and bundled him back to Kimberley.

Marks remembered Stow's prospecting results years later when it was clear that a great many wood-fired steam engines on the Witwatersrand would grind to a halt unless another form of fuel was used to supplement it. Marks confirmed Stow's findings by sinking a test shaft at the site and it convinced him that the coal resources there were sufficient to last about 100 years or more.

In fact, coal is still being mined on the southern side of the Vaal River to this day and Eskom built its Vaal power station at Viljoensdrif, a spot on the Vaal River near Parys where coal was carried across the river to the Witwatersrand by ox-wagon. That power station, built in 1945 had a total nominal capacity of 290 MW and was only shut

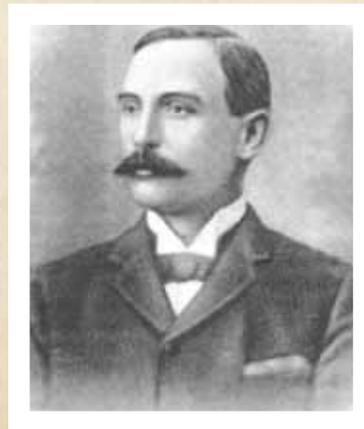
down in 1989. But that's another story, I suppose.

Marks, with his partner, Lewis convinced a consortium of investors to form the Zuid Afrikaansche en Oranje-Vrijstaatsche Kolen- en Mineralen-Mijnen Vereeniging (or the South African and Orange Free State Coal and Mineral Mining Association) and George Stow even received 10 of the 75 original shares for his discovery.

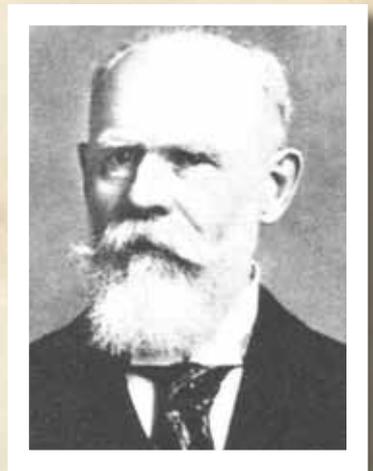
For a while in the 1880s, this mine supplied coal to Kimberley at a transport cost of £8 a ton, a mining cost of just £2 and a retail price of £15 a ton. It was a highly profitable business then, and it became even more profitable when the gold mines on the Witwatersrand demanded coal for the steam engines that powered the stamp batteries.

To Marks' disappointment and annoyance, coal was discovered just 30 kilometres east of Johannesburg, firstly, in Boksburg and later in Brakpan and even in Springs. At the time, Marks' colliery was producing and selling about 200 tons of coal a week and this coal had to be sorted, bagged and then lugged to Johannesburg by ox-wagon at a cost of 30 shillings a ton.

As soon as the new coal mines were working just 30 km east of Johannesburg, many hundreds of wagons were engaged to cart coal to the mines on the Witwatersrand. The task of moving coal was laborious, slow and expensive so to overcome the problem, the Nederlandsche Zuid-Afrikaansche Spoorweg-Maatschappij (Netherlands-South African Railway Company) or NZASM finally convinced Paul Kruger, President of the Boer Republic, to grant it a concession to complete a



John Hubert Davies, the Johannesburg Electrical Engineer who, together with Siemens & Halske, entered into an agreement to establish a joint company to supply power to the mines on Witwatersrand.



Arnold von Siemens.

The Brakpan Power Station of the Rand Central Electric Works.

tramline between Johannesburg and Boksburg in 1890, and to open a line between Pretoria and Germiston shortly after that.

With the opening of the tramline between the East Rand and the mines, the price of coal dropped from 26 shillings a ton to just 6 shillings because of the more efficient transportation network. While the railway was a real boon to the miners, the owners of ox-wagons that previously carried coal to the mines were frustrated and angered because their means of survival had been taken away.

So much so, that the first railway accident on the line was actually symptomatic of their feelings. The last train that left Boksburg station on 8 May 1890 came into a violent collision with a bulky object just after it had puffed-out of Germiston station. There was no damage to the train and the driver was not injured. He reversed, jumped down from the footplate and found he had hit an ox-wagon, heavily laden with coal, and outspanned across the line.

The wagon driver was arrested for attempted wrecking, the coal was shovelled away and the train limped home to its shed in Johannesburg. As the mines developed and grew, so the demand for coal increased and by June 1890, several mines were actually forced to suspend their operations because of non-delivery of coal to feed the steam engines.

By 1892 there was already considerable interest in the use of electricity to power the stamp batteries rather than using steam engines. One of the earliest proponents of electricity in South Africa, J Hubert Davies, invited members of the South African Association of Engineers and Architects to see the 120-stamp mill at the mine and to inspect the electrical plant used to transmit power.

The gold mine was one of the first to whole-heartedly adopt electricity as its primary source of power and it was soon followed by the other mines in the area, dealing a blow to the coal mines around

Johannesburg – but it was not a fatal blow as steam engines were used to drive turbines and generate electricity anyway.

In his explanation of the savings offered by electricity, Davis told delegates that, until recently, it had been standard practice to have separate engines and boilers for different purposes. "For instance, there are hauling engines, mine pumps, cyanide work pumps and workshops, not to mention the hauling of ore from the mill, which is usually done by mules," he said.

"With various steam plants distributed over the property to do the different work, not only is the cost of fuel excessive and the nuisance and waste of coal bunkers great, but the labour involved in attendance on the machinery is enormous," he said.

He went on to tell his audience that by using electrical power it was possible to increase the efficiency of the motors from 66 percent to 85 percent.

"It must have struck you at first sight that here the attendance required on the electric motor is extremely small. These large pumps and the motor driving them can be left alone and the house locked up for very considerable periods.

"In fact many of my plants work this way and I have sometimes had to walk a considerable distance to get a key to the pump-house, which is kept locked up, the plant inside taking good care of itself."

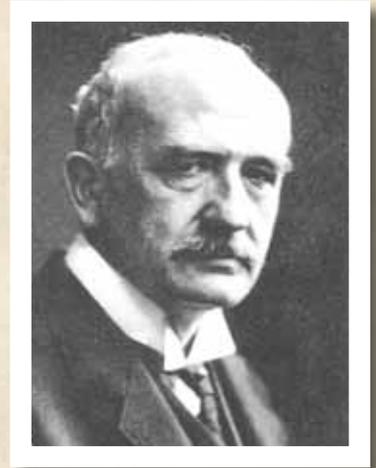
He went on to tell the group that the dynamos of the same type as the machine they were looking at had been running daily for five years he doubted if repairs to them had cost even £2.

Of course the visitors were impressed and so they should have been considering how efficient electrical power is.

By 1894, Siemens & Halske from Berlin, Germany and John Hubert Davies of Johannesburg applied for permission to lay main electrical



The official visit of President Paul Kruger and Members of the Volksraad to the Rand Central Electric Works at Brakpan on 18 September, 1897.



Wilhelm von Siemens.

transmission lines, with branch lines, along the Witwatersrand gold reef for the "purpose of supplying power and light, by means of electricity, to the mines, companies, houses and persons in the neighbourhood of the main and branch lines."

Siemens & Halske was a well established firm of electrical engineers and manufacturers of electrical plant and they entered into a joint venture with Davies to exploit the rights they had been granted by government. Siemens & Halske were the consulting engineers to the new company and would supply the plant and material for the high-voltage transformers. Hubert Davies would be the sole agent supplying the material and equipment for power installations at the mining works, commercial or industrial buildings and private properties.

Davies would also supply transmission lines, step-up and step-down transformers, cable, wires, instruments, meters, switches and lamps for lighting purposes as well as electric motors. There was no doubt that Davies would, very soon, be an extremely wealthy man and the Siemens & Halske organisation would grow into one of the dominant forces in the electrical sector (and later others too) in the world.

The concession to Siemens & Halske was formally granted in 1894, and included the following provision:

"The government grants to the firm Siemens & Halske, in as far as such is not in conflict with rights already granted, the right to erect poles and to fix electrical conductors to the same on government grounds, public road and proclaimed goldfields in the districts of Pretoria and Heidelberg. . .

"This grant consists, in the first place, of a conductor from one of the coal mines situated between Springs and Brakpan to the farm

Paardekraal, with branches for the mines and in the second place of provisional right for a conductor from the farms of Hartebeestfontein and Zwartkopjes along Krugersdorp to the farm Paardekraal."

The concession also acknowledged the growing importance of telecommunications as an integral part of the power system but limited its use with the provision that the government would consent to the "attaching of two telephone wires to the same poles, exclusively for the use of the electric power station together with the offices belonging thereto and the connected mines."

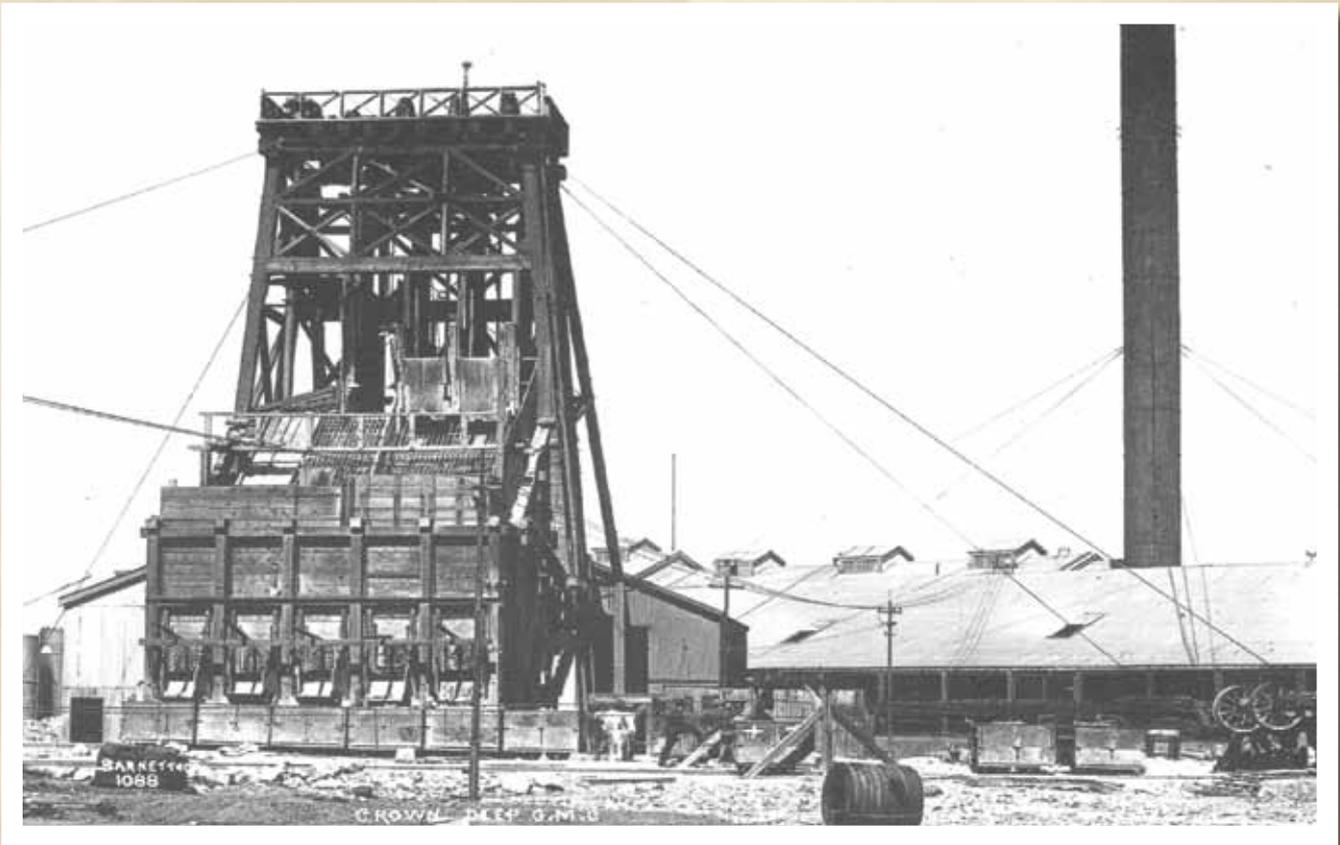
In return for the concession, Siemens & Halske were to pay a two-and-a-half percent royalty of its annual net profits, to the government, with a minimum payment of £500 a year.

As it happened, the three members of the Siemens family, Arnold, Wilhelm and Carl Heinrich von Siemens, together with the co-partnership of Siemens & Halske in Germany, ceded all their rights to the Rand Central Electrical Works Limited (RCEW).

A sum of £1 000 was deposited with the government as caution money. In return, the Von Siemens family members and Siemens & Halske received 19 000 shares in RCEW and £1 000 in cash. The other main shareholders of the new company were Hubert Davies with 1 000 shares and Edward Lippert with 5 000 shares.

Thus it was that the RCEW, with Siemens, Hubert Davies and Lippert as the main shareholders, were the first central power station to supply electricity on a commercial basis to the gold mines of the Witwatersrand.

Building operations for the power station began in Brakpan in 1895 and the station generated electrical power for the first time in May



The headgear at the Crown Mines Deep Gold Mining Company, one of the first mines to use electrical power for a number of different purposes.

1897. Siemens & Halske certified that the works were completed by July that year when the power station was generating 700 kW of power – barely enough to run a small village of say 300 or 400 modern homes today.

Within a few months, mines were being granted concessions to erect and run their own power stations. Simmer & Jack mines were given a concession to supply their own power in July 1897 and this concession was ceded to General Electric Power Company which was financed by the Consolidated Gold Fields Group belonging to Cecil John Rhodes.

Of course the fortunes of the three pioneering companies in South Africa's electricity supply were to develop dramatically. Siemens & Halske (now Siemens) is one of the world's major employers with branches throughout the world; General Electric remains one of the dominant players in the world of electricity and power – along with many subsidiary organisations and diverse interests on all five continents; Hubert Davies eventually became Hudaco, a major South African industrial company as well.

It was the emergence of electricity as a primary source of power throughout the country that contributed to the formation, years later, of the South African Institute of Electrical Engineers which celebrates its centenary this year.

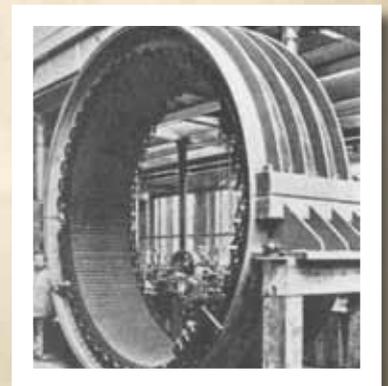
Of course, by 1909 when the Institute was formed, electricity was commonplace in the mines, the new homes, all new buildings and the many industrial concerns in the major centre of South Africa.

Thus, it was hardly surprising, that an official body, capable of promoting the electrical engineering profession, was able to open offices in the main centres and attract members from all the many different disciplines that, already, were to be found the electrical sector.

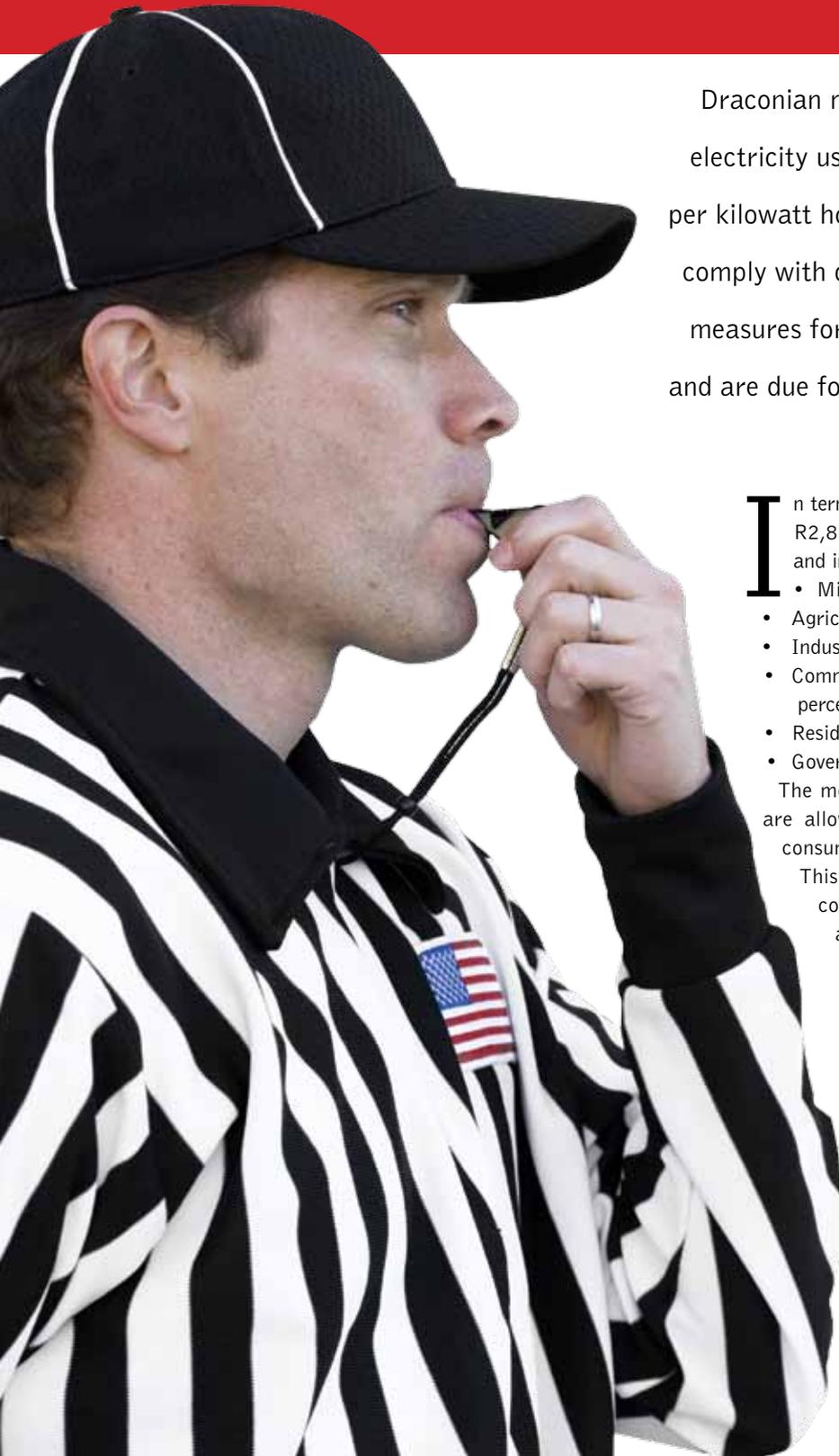
And, I suppose, without the combination of endless supplies of coal, the wealth generated by the gold mines, the foresight of organisations and individuals such as Siemens & Halske and Hubert Davis, it might have taken South Africa many more years to reach the advanced state its electrical industry found itself in during the first years of the 20th Century.

South Africa was leading the way – not just in gold mining, but in electricity generation for mining machinery too.

Stator for one of the three-phase generators for the Rand Central Electrical Works Brakpan Power Station.



Penalty tariffs could hammer mining and industrial companies



Draconian measures to force consumers to cut down on electricity usage could see punitive charges of up to R18 per kilowatt hour being imposed on companies that do not comply with demands to cut electricity consumption. The measures form part of the Energy Conservation Scheme and are due for public hearings in April with the measures being put in place by May this year.

In terms of the draft regulations, penalties will range between R2,80 and R18 per kilowatt hour. The targets for the consumers and industry have been set as:

- Mining – eight percent
- Agriculture – eight percent
- Industry – 10 percent
- Commercial companies (including shopping centres) – 20 percent
- Residential – 20 percent
- Government and state-owned enterprises – 25 percent.

The monthly energy allocation that households or businesses are allowed is calculated by calculating the average energy consumption between October 2006 and September 2007.

This is the baseline (in other words the period before Eskom commenced load-shedding) and the savings are measured against these figures.

Failure to meet the targets will result in rapidly escalating energy rates depending on how high energy consumption is. For example, a commercial customer is required to save 20 percent but if electricity consumption is maintained at baseline then no savings will have been achieved. By not saving electricity the consumer will attract punitive rates. Thus the monthly electricity bill could increase by 4,6 times in the first month, then 6,4 times in the second month and finally 8,2 times in the third month.

The proposed penalties for second and third transgression (in other words for those customers who exceed their monthly energy allocation frequently could mean that the full penalty tariffs are imposed.

These tariffs are set at R2,80 per kilowatt hour for electricity supplied in the control band, R4,50 per kilowatt hour for electricity supplied in the disincentive band and R9,00 per kilowatt hour for electricity supplied in the punitive band.

The energy conservation scheme will require all consumers to achieve energy savings although the National Electricity Regulator of South Africa (Nersa) is considering providing an incentive to electricity consumers who actually exceed the savings targets that have been set.

Eskom spokesman, Fani Zulu, has defended the draconian measures by saying that it the action is a "necessary measure" because, for many years, electricity demand has been growing and Eskom has been unable to keep pace with the increases.

Eskom is spending about R343-billion on building new power stations and returning older power stations to service.

The measures have been roundly criticised by industry and trade unions alike and Zwelinzima Vavi, general secretary of major trade union group, Cosatu, claimed that big business should bear the brunt of the cuts and ordinary household consumers should not be penalised at all.

Economist, Dawie Roodt, of the Efficient Group has warned that imposing penalties on consumers is, in his view, a "silly and impractical idea". He believes the solution is to make electricity more expensive and, at the same time, privatise electricity generation and distribution.

Surprisingly, there is no incentive from Eskom or Nersa to introduce programmes among industrial manufacturing companies that will help to reduce energy consumption.

Technologies such as Smart Logistics, Smart Motors, Smart Grids and Smart Buildings should be endorsed by Nersa and Eskom and industrial consumers should be encouraged to deploy such solutions.

Dou de Kock, chairman of the energy efficiency task team of the South African Property Owners Association, has warned that regional shopping centres owners could be forced to close down because the penalty charges they could incur would make the shopping centres uneconomical.

He says the proposed penalties would result in millions of rands in extra charges that will have to be passed on to the tenants in the malls.

Dean Goddard, an energy and environmental consultant at Growthpoint, says that property owners were still struggling because of the high electricity price rises imposed last year and warned that if Eskom increases its price this year tenants start leaving the malls.

However, Kannan Lakmeeha-ran, managing director of Eskom's systems operation and planning has a different view and claims that the Nersa programme is not really about penalties but rather to encourage savings.

Lakmeeharan claims that Eskom had done the preparatory work on the electricity conservation scheme on behalf of the government and had submitted its recommendations to Nersa.

Nersa's head of communication and stakeholder management, Charles Hlebel, says that all energy conservation scheme rules

have been carefully considered and, once the public hearings have been held in April, the organisation will decide on the penalties.

Interestingly, none of the organisations involved in implementing penalty tariffs have given any indication of where the money generated from these penalties will end up. Will Eskom get the benefit of more cash in its coffers or will the penalties be paid to Nersa?

Eskom has already made its submission to Nersa for its annual tariff increase but neither of these organisations is prepared to say how much the electricity price is likely to rise. Moreover, Nersa has not been able to set a definite date for the implementation of the penalty tariffs.

The African National Congress's spokesperson, Jessie Duarte, has urged all South Africans to continue saving energy and she has called on ANC members to make a concerted effort to reduce energy consumption through a door-to-door community awareness programme. She says that pamphlets containing energy savings tips will be handed out to households around the country.

Furthermore, she says, the public has been encouraged to 'name and shame' government departments or commercial organisations that do not implement energy saving measures.

In a separate development, Nersa has confirmed that it is planning to introduce its Renewal Energy Feed-in Tariff (REFIT) programme, which proposes mandatory targets and rules for the power conservation programme, a plan that it hopes will be adopted within a few months.

The REFIT programme has also been widely criticised by industry, and Dr Ruth Rabinowitz, convenor of the e-Parliament Renewable Energy Activists (e-React) and an Inkatha Freedom Party Member of Parliament, says that the draft regulations demonstrate a "shallow understanding of energy economics, with a narrow interpretation that would still allow Eskom a vast amount of discretionary control over electricity distribution."

The success of the REFIT is largely dependent on the tariffs being applied and in terms of the current guidelines, electricity generated from wind will attract a tariff of 65,48 cents per kilowatt hour, dropping to 57,84 cents per kw/h by 2013. Hydro power would start at 73,76 cents per kw/h falling to 71,63 cents per kw/h and tariffs for landfill gas projects would start at 43,21 cents per kw/h dropping to 40,75 cents per kw/h over five years. Finally tariffs for concentrated solar thermal power would start at 60,64 cents per kw/h and drop to 57,67 cents per kw/h.

Nersa believes that the REFIT programme generate 8 324 GWh of electricity by 2013 and that 84 percent of this will come from hydro-electric sources. However, as Macquarie Renewables' Anton Rohner points out, South Africa already has water capacity constraints so hydro-electric power is unlikely to be a major source of new generating capacity. He says that energy solutions such as wind power or solar power represent a more viable alternative.



Rohner claims that the tariffs, too, are so low that investors or speculators will not be easily persuaded to invest in renewable energy projects. He has urged Nersa to hike tariffs for renewable energy to a more realistic level of between 95 cents and R1,05 per kW/h.

Stuart Friedman, managing director of Cullinan Energy Solutions agrees that the tariffs are way too low and says that, in his opinion, the tariffs should start at about R1,85 per kW/h.

Dr Rabinowitz says that while an urgent implementation of the REFIT programme is required if one considers that Eskom produces 87 percent of its electricity from coal and just four percent from nuclear sources. A meagre 1,6 percent comes from hydro-electric schemes and three percent from pumped storage schemes.

She claims that the long-held belief that coal provides the cheapest form of electricity is losing its validity today. The new coal-fired power stations will mean the cost of electricity is about 65 cents per kW/h without a carbon tax and close to 85 cents once the carbon tax has been included.

Rabinowitz says this compares with R1 per kW/h for wind power and about R1,20 per kW/h for concentrated solar thermal power and these options do not attract carbon tax either. She says that South Africa could achieve about 15 percent of its energy requirements by 2020 if the government's REFIT programme is attractive to investors.

Nersa is due to release a new draft of the REFIT programme and once this draft is published, further public comment will be called for.

Meanwhile, Thembanani Bukula, a regulator member of Nersa has said that the organisation will consider the prevailing economic conditions when it receives Eskom's application for a price hike.

Bukula says that economic conditions in South Africa have changed radically since the last price hike was approved in June last year and as a result, Nersa will have to re-evaluate the implications of a tariff hike on consumers countrywide.

South Africa's Treasury Department has confirmed that it will provide Eskom with loan guarantees of R175,97-billion over the next five years to help it raise sufficient funds to implement the R343-billion investment in new power generation.

Eskom currently provides about 95 percent of the power consumed in South Africa. Last year, when Nersa granted Eskom its 27,5 percent price increase, the organisation warned that electricity tariffs would have to rise by between 20 percent and 25 percent a year for at least the next three years, but Bukula says this calculation may change given the prevailing economic conditions.

SA should rely on renewable energy



The World Wildlife Fund says that South Africa should be concentrating its resources on developing renewable energy plants because more than 90 percent of all this country's energy requirements could be met from a combination of solar energy, wind power, hydro-electric schemes and so forth. It says that while South Africa has enormous reserve of coal, Eskom and the other Independent Power Producers should concentrate on using sustainable energy rather than burning even more fossil fuels.

Cosatu vows to strike if electricity price increases

Labour federation, Cosatu, has warned that it will embark on a national strike if Eskom's tariff increase is anywhere the same level of 27,5 percent granted by the National Electricity Regulator of South Africa (Nersa) last year.

Cosatu's general secretary, Zwelinzima Vavi, says the federation will not accept any increase in electricity prices until a national tariff policy has been established with guarantees that the poor people of South Africa will be protected.

Vavi says that Cosatu's members will embark on a national strike and take to the streets around the country if the electricity tariffs rise by a similar rate imposed last year.

According to Vavi, the Federation had not agreed to last year's price increase and warned that a similar increase this year would be "vigorously opposed" by the union. He warns that Cosatu plans to submit a notice of its intention to embark on a national strike to Nedlac ahead of the price determination from Nersa.

Eskom has submitted its application for a price rise to Nersa but neither body is prepared to comment on the exact extent of the proposed tariff increase. Moreover, it is impossible for Nersa to implement the price rise by 1 April and as a result the tariff increase is likely to be back-dated once it has been approved.



The Matric Problem: Some comments

The article published in the February issue of WATTnow attempts to analyse the present situation, to provide some historical perspective, and to make some tentative proposals of possible solutions.

We seem to be facing a conundrum around the matric examination. The old configuration, with all its benefits and limitations has been discarded, and the replacement seems no better, perhaps worse.

Let us firstly examine the intentions of the whole matric examination structure. It seems to serve three different functions:

- A check is needed by the education authority to verify that the "Educators" have done a satisfactory job in implementing "Departmental Policy" and have produced a batch of satisfactorily educated "Learners". This can be seen as analogous of an industrial post-manufacturing inspection process, where deficiencies in individual products are identified and corrected. Studies must also be made here on the needs and possibilities of process- and product improvement.
- The tertiary education institutions (universities and others) need to evaluate prospective students for an adequate educational foundation which would enable them to study further. (It must be emphasised that it is not the function of a university to teach its students basic reading and writing skills in their chosen language of instruction or counting and basic arithmetic.)
A historical perspective here is that the word "matriculation" really means enrolling at a university as an undergraduate student. It seems to be used today in that context mainly by Scottish universities.
- The community at large, including prospective employers, desire to know that the high-school graduates are at least literate, and are fit to take a place in society and employment. Employers also feel that it is not their function to teach their junior employees basic reading and writing skills and basic arithmetic.

With these requirements in mind, we need to ask to what degree the matric examination, in both its 'new' and 'old' formats can be regarded as satisfactory?

The first point of "educational quality assurance" is not really visible to the general public, but the overall perception is that the education authorities pay little heed to this matter. There are far too many tales extant of unsatisfactory teaching performance being tolerated or ignored (for whatever reasons may prevail) to have any belief that this function is even recognised, let alone being carried out. Clearly there is room for much improvement in this area.

The universities seem to be caught in the cross-fire between their own academic needs and an unstated need to work with the student material they are given by "the system".

There has even been a proposal for a separate matriculation examination to be instituted with a higher standard, to suit the universities, but the logistic problems of such an undertaking on a country-wide scale would be immense. It would also create an enormous public outcry against such a perceived duplication of effort, and against the high costs of

the large cottage-industry of cram-colleges needed to prepare the candidates for such an examination. (By definition, the high schools in their present form would largely be ruled out.) There are also some with vested interests within the existing educational sector who would oppose such a move.

The requirements of the business sector are disparate in nature, and are difficult to quantify, considering that there is a desire to employ only experienced staff, without any serious examination of how this experience can be acquired. (This is a common case of the "Somebody Else's Problem" syndrome.) The needs of different businesses are so divergent that it is difficult to visualise a universal "business education" training, although in some areas such training does already exist, with varied degrees of success (e.g. "secretarial colleges" and sub degree-level "IT training institutions"). The common practical solution will probably have to remain informal on-the-job training.

What is the way forward? The Education Minister, Naledi Pandor's, much-criticised plea to separate curriculum issues from teaching-method issues does make a great deal of sense, without implying that there are not serious problems in both areas. To attempt to solve all such problems with one set of actions is just another case of a "one-size-fits-all" approach.

The implied view that all was well in the previous education dispensation does not stand up to any detailed analysis, although the criticism seems to be well founded that the newer mathematics-related curriculum, particularly the debacle of the "Maths Literacy" course, has seriously exacerbated the problem.

The teaching methods described as "OBE" seem to be having serious teething problems. There are reported to be ongoing problems related to grossly inadequate teacher-training in the new methods, and also a seriously excessive workload on the teachers. It would seem that the OBE methods require a much greater attention to detail by the teachers, this in an environment where pupil/staff ratios are up to 50 pupils or more per class. It has been stated that anything above 25:1 is unworkable. Even in the past, a ratio above 30:1 was severely criticised.

The perceived high drop-out level among university students is nothing new, except perhaps in the detail of the numbers: around 50 years ago, at Wits University, each year there was an intake of 70 – 75 fresh matriculants in each of the more popular branches of engineering. Four years later, at graduation, these numbers had shrunk to about 20. This represents a drop-out rate in the region of 70%. Even matric high-flyers were then not immune to the drop-out problem.

The generally-accepted explanation at that time (and probably still partially true today) was the great disparity between high-school and university teaching methods. This disparity seems to have grown wider recently, resulting in a strong recognition of the need for "bridging school" methods on or before university entry.

The means to cover the extra costs and staff complement this would entail are still a matter of contention.

It almost seems that the universities even then had little confidence

in the matric examination, and were prepared to throw their doors open as wide as possible, and to do their own “filtering” of students, since most drop-outs occurred after the first year of study and the correlation between failing students and their matric results was then poor.

In recent years, a large parastatal organisation, in the defence industry, ran a one-year pre-university bridging-school programme for matriculants who wanted to improve their marks in the science-based subjects needed by potential engineering and science students.

At the end of the year, the students would re-write some matric subjects, and would then come into consideration for tertiary-education bursaries from the parent organisation. It provided about 100 student places each year, and reportedly received well over 4000 applications a year from prospective students.

The results from those lucky (or talented) enough to be selected were highly encouraging, but the costs involved would have been very high, so it is doubtful that such institutions can make a big contribution to the solution of the problems without significant financial support. It is reported that some highly-regarded high schools are asking around R20 000 per pupil a year for tuition. Multiplying this by the number of matriculants needing help (seemingly in the tens of thousands each year) gives some indication of the size of the problem.

Further comment from anyone interested or involved would be welcome. Unanswered questions seem to revolve around the formulation of the details of a revision to the curriculum, the improvement of teaching standards and facilities, and the financing of the needed changes.

Tony Fisher, Retired Member, SAIEE

Dear Paddy

I write to you, as you seem to be the latest reason for my ‘old cry’: “There is no shortage of engineers in South Africa”

I’m responding to Stan Bridgens’ wise words in the latest issue of WATTNOW

Please note, I write in my personal capacity.

When I was around 60 years of age, around the turn of the century, I could not find work. Eventually after three years of unemployment, I managed to find something at R160 per hour (note being hard-up my asking price was R100). I’m lucky enough to be employed today, but don’t know how long it is going to last with the economic slowdown.

A recent statement by ECSA that there are now 1 100 fewer registered professional engineers in South Africa than 10 years ago, means to me that there were 1 100 too many 10 years ago. I have not heard of a project that was stopped, because there were no engineers.

April 2009

A recently qualified Mechanical Engineer, a friend of my son’s, cannot find work, because everyone is looking for five years practical experience. The magic phrase “A 35 year old with 35 years experience” still prevails.

We are all engineers because we love it, but unfortunately are not rewarded for our work.

As you quoted Stan Bridgens in the article that there are serious shortages of engineers at municipalities this does not mean that there are no engineers wanting to work at municipalities. Rather it means that engineers cannot support families with school fees etc. at the low remuneration rates they are offered by municipalities.

When I revisited a small municipality, where I installed an expansion to the sewage system about 15 years ago, the operator, who was still there, told me that he could not keep the plant going the way it was designed to work because the municipality did not buy the chemicals required (Note: Shortage of chemicals, not engineers).

Guess what happens to the sewage?

If you know of any of the better off section of our population (mostly B.Com.) you will find that they live at the higher standard because they deal with money. They hate their work, but have the life. I’ve heard of projects being stopped because of money. Money makes the world go round.

My belief is still: Pay for the services and you will get them. If the demand prevails, you will attract newcomers.

Let me also say hello to my old friend from ‘varsity, Starkie. I’m not as fit as he is, but I’ll still do any full time engineering job.

Sorry guys, but since I’ve drawn ‘the dole’ for six months, I will keep on contradicting you when you say there is a shortage of engineers. I really don’t believe there is.

Henk Lantermans Pr.Eng.

The Editor Replies

My own view is that this is really a matter of semantics. It is possible that the shortage of engineers might not bring projects to a halt but where we see the most detrimental effects is when we look at the maintenance problems that occur at, for instance, the water purification plants at the respective municipalities.

Because there are no trained engineers running these plants, the water and sanitation in hundreds of municipalities is not up to scratch and people are getting diseases, fish are dying, entire ecosystems are being destroyed.

That’s where the shortage of engineers is most notable and I think that even you will agree that South Africa has a problem at its water purification plants and its power stations as well. Why? No engineers

Wind power, research and a cappuccino too

By Peter Middleton



The TechnoSpin wind generator – rated at 2,0 kW at 10 m/s – being commissioned on the roof of the Chamber of Mines building at Wits University.

I was recently invited to drink 'a wind-powered cappuccino' at the commissioning of a wind turbine on the roof of the Chamber of Mines building, on the West Campus of Wits University. The West campus used to house the flower hall, a key examination venue in my day, so my return wasn't without that 'I would rather be somewhere else' feeling – but hey, how hard can drinking a cappuccino be?

I was early, and so I followed the 'Wind Turbine' signs all the way up the stairs of the building and onto the roof. I met our host James Braid, rushing down the stairs. The event was going to be held on the roof itself but, due to the weather forecast, he had decided to drop a cable down to the second floor and set up the equipment (a cappuccino machine, inverter and battery pack) outside his laboratory.

On the roof I met a man called Daniel Schwab, managing director of Kayema Energy Group and the key sponsor of the TechnoSpin wind

generator being commissioned. Together we watched the small turbine turn. He looked rather proud and a little reluctant to leave the machine by itself. I asked him about the turbine's output: 2,0 kW at 10 m/s, he responds. Standing on the roof, we feel very little wind, but the turbine above us, is turning energetically. "There is not a lot of wind up there at the moment," Schwab tells me – "maybe 2,5 to 3,0 m/s."

Now, to me, a single 2,0 kW generator seems a far more attractive renewable energy offering than the idea of a multitude of 100 W solar panels, but to get the 2,0 kW, you do need wind blowing at 10 m/s. Downstairs, I asked Braid about the turbine's output at lower wind speeds. It's a cubic law, he informs me, so if the wind speed halves, the power drops eight-fold – 250 W at 5 m/s then, not quite such an attractive proposal – or is it?

Wind is a 24-hour resource and not negatively affected by cloud cover – so if, on average 250 W can be collected over a 24-hour period, you are generating 6,0 kWh of energy every day, around R3,00 worth at SA's exceptionally low 50 cent rate. That adds up to R90-odd per month or R1 095 per year – easily 10% of my monthly electricity costs.

Before the coffee begins to flow, Braid gives a short presentation: The commissioning of the turbine is the start of a series of projects to see how feasible wind power is in Gauteng, he tells us. "This is just a fun demonstration project to show that it can be done. It has already shown that there is wind in Johannesburg, even if it's just a little.

"What we hope is that the turbine will kick-start a whole range of research opportunities – blade design, generator design, solar water heater design, biofuels and renewable energy research – across the electrical, mechanical and chemical disciplines," he says.

So renewable energy research is really alive and going places at Wits," he says. It also provides an opportunity to teach students in the renewable energy field, he adds. "Now that we have a turbine, we can do lots of experiments, and this is far more important than just having a toy to play with."

He briefly describes his wind-powered cappuccino system: The turbine on the roof is connected directly to two batteries on the right of the table – two 12 V deep cycle batteries are connected in series to give a 24 V output. The batteries are used to supply a DC to AC inverter, which is supplying the cappuccino machine with 1,5 kVA of AC power – nearly equivalent to one 10 A socket. "This is a totally off-grid solution. The battery will store the power from the turbine when it is not needed and supply it, via the inverter, on demand," says Braid.

Why a cappuccino machine? "Coffee machines like this have a lot of electronics, which are sensitive to supply voltage changes and, because it involves a heating element switching on and off, it also represents a changing load. It is quite a sophisticated load to drive, which makes it a good test for powering other digital electronic devices



The wind powered coffee system – a cappuccino machine, inverter and a battery pack – being recharged by a wind turbine on the roof.

– so if you can power this coffee machine, you can power just about anything.” Nothing to do with late nights, hangovers or impressing girlfriends then.

A second presentation follows, by Dr Daniel Irurah of the School of Architecture in the Faculty of Engineering and the Built Environment. He tells us of his department’s focus on renewable energy in buildings. The wind turbine mounted on the roof of the Chamber of Mines building, began during a workshop in 2006 and, as a result, a programme emerged between his department and a sustainable solutions organisation called Second Nature – in collaboration with Kayema Energy Group – and funded by Second Nature through PRIA – Promoting Renewable Energy in Africa.

“Small wind turbines mounted on buildings are different from the huge mini-farms that we usually associate with wind generators,” Irurah tells us. “This turbine will give us the opportunity to find out what happens on buildings. Buildings are already high and therefore obviate the need for tall and expensive mast structures. Also of interest in terms of buildings is how wind might be amplified as it is channelled between the rows of buildings in an urban environment. The intention is to both monitor and measure wind speeds in built-up places around Johannesburg and also to build models of urban streets for testing in wind-tunnels.

Over coffee, I talk to Professor Willie Cronje from the Department of Electrical Engineering. He tells me about the ongoing negotiations between the renewable energy providers and NERSA – SA’s national energy regulator – regarding tariffs for renewable energy.

Nersa proposed renewable energy tariffs in December last year. Renewable energy companies all believe these tariffs to be critical in the development of a local renewable energy industry, as it gives prospective investors clarity on financial returns.

The idea is that a ‘cost-plus’ buy-back model will give investors an incentive to fund more expensive renewable energy options in order to achieve the government’s 10 000 GWh of renewable energy contributions by 2013. Nersa’s proposed tariff – for buying back power placed on the national grid from wind technology sources – was 65,48 c/kWh.

Cronje believes that the regulator needs to review this situation. “The proposal is nothing compared to the incentives in Europe”, he says. “A small micro-turbine will cost around US\$6 000, R60 000 for the turbine, then you may still need to spend a further R2 000 on batteries and R12 000 on an inverter. “It costs a lot of money to get it going and if you can sell the energy back to the utility it makes it easier. France, Germany and Europe give you an excellent rate, paying around 0,5 Euros (R5,00) as compared to the electricity cost of 0,15 Euros (R1,50). You sell at three times more than you buy,” he explains, “to help subsidise the capital expenditure.”

In South Africa, the proposed sell-to-buy ratio is so close that not many investors will be interested – an approximate 15 cents additional margin for wind regeneration. A 2,0 kW installation in Gauteng, providing 6,0 kWh per day, will give a net return of R0,90 per day at the proposed rate, and an approximate pay-back time of 213 years on a capital investment of, say, R70 000.

Unattractive indeed.

And at the coast? If you can generate 2,0 kW of continuous output, then you can produce 48 kWh in each 24-hour period, a net return of R7,20 per day and a payback period just short of 27 years – still distinctly unattractive as an investment.

“At the end of the day, it all comes down to rands and cents,” says Cronje. “If you have to go to the bank to borrow the money to install the unit, you have to be able to make enough to pay the money back again. If you have enough wind you will generate power, but you will only have a viable technology if Eskom pays a realistic price for the power you generate,” – a price that enables investors to justify the initial installation.

I found a snippet on the internet about Australia, which has similar coal-dominated generating capacity to South Africa. Australia currently has no nationalised programme, only state-run schemes. Victorian households, for example, will be paid a net feed in tariff of 60 Australian cents (R3,95 at today’s rate) for every unused kilowatt hour of power fed back into the state electricity grid, which is almost four times the current retail price for electricity and the highest feed-in tariff offered in Australia.

James Braid may yet prove that wind is viable in Gauteng, but Nersa’s decisions will be the ones that really matter.

The realities of OBE – from a student’s perspective

By Mathew Holmes

This article was submitted to WATTnow by Mathew Holmes, a first year Bachelor of Science student at the University of the Witwatersrand in response to the articles published in the February issue of the magazine entitled: *A ‘lost generation’ of students educated under OBE* and *A way to fix the crisis in maths education*.

I thought that these stories would be all just statistics and probably not have a large impact on my future as a student who matriculated last year under the Outcomes Based Education (OBE) system.

Yet, recently I began to feel that, indeed, my education was lacking in necessary aspects, especially in mathematics. During my first week of study at Wits – where I intend studying Physics as part of my BSc degree – I discovered that a new system had been put in place for all first year Maths Major students.

We are required to complete an online self-study course at CourseCompass.com, which includes homework and provides an e-book for students so that they can supplement the mathematics we were taught in Grade 12. It also provides basic knowledge needs for our actual maths major course.

I noticed that there are a lot of fundamentals that I am missing, (even though I took the optional maths Paper 3 in matric.) For example, our matric syllabus involved the use and knowledge of three trigonometric functions (Sin, Cos and Tan). We were not taught or examined on their respective reciprocals. This was, however, included in the older syllabus. A fellow student who matriculated in a government school two years ago seemed to know much more about it than I do. He is also studying for a BSc.

Then, I attempted to complete the first week’s online homework, only to discover that I had never worked with ‘radians’ before. I am not certain if this was included in the older matric syllabus, but it is in my opinion, important to have a basic knowledge in this as at university level we are seldom working in ‘degrees’. Perhaps those who are thinking of studying further could learn fundamentals like this in a Higher Grade course at school? Hold on, isn’t that what we had?

In my second physics lecture differentiation was discussed. There were a few laws that our lecturer frantically attempted to teach us after discovering that the majority of the class had not been taught these laws before. Another consequence of a shortfall in the mathematics syllabus?

It is true that almost everything I have stated above cannot be motivated by fact, but I am aware that there definitely was the removal of the reciprocal trigonometric functions from the matric syllabus, as last year we were informed of this by our maths teacher.

Obviously something had to be removed from the syllabus if a Higher Grade course and a Standard Grade course were combined into a single course. It is a fact that the mathematics exam was of “an unacceptable standard”, but even so, by increasing the standard and leaving out fundamental concepts in the syllabus we are still left with many learners who cope extremely well in certain aspects of mathematics, yet are left in the dark in others.

This is coming from the mouth of someone who achieved 87 percent in Mathematics and 83 percent in the optional Mathematics Paper 3. Therefore my above complaints cannot be opposed by statements such as, “you are simply not mathematically minded, and that is why you are battling with some fundamental concepts”.

WITS conducted a test before the first semester began. This was compulsory among all first year students who matriculated with mathematics as a subject. It was called the National Benchmark Test, and was used as research to establish the standards of the knowledge that students picked up in their matriculation year.

I am curious to see what the analysis of this data will reveal.

I suspect we will see a decrease in students passing mathematics at first year university level, and this will certainly lead to a drop in scientists and engineers who graduate in a few years time. That’s a very worrying and disturbing thought given the shortage we face as a nation.

In fact, the shortage of engineers and scientists in South Africa will worsen.

I also think that all of us, who wish to pursue a career in science or engineering, are being hampered by the one-size-fits-all approach of OBE and the consequences of this education system will be measured in years to come.

And, I fear that I will be a victim of an improper education system for the rest of my life.



Silica gel – a useful product that may be hazardous

By Derek Woodburn, Pr.Eng., FSAIEE.

Silica Gel was invented or discovered seventy years ago, and has been extensively used in the electrical industry for maintaining the oil in large transformers in a dry condition. The blue form of silica gel is a stable, chemically and biologically inert compound of synthetic amorphous silica impregnated with cobalt chloride, which does not burn and is insoluble in water and other solvents.

Manufactured in the form of blue granules or beads, which turn pink when they absorb moisture and become saturated, silica gel can absorb up to 40 percent of its own mass in water. The colour-change component, cobalt chloride, forms less than one percent of the material mass-impregnated in the silica gel.

With careful handling, the product can be safely recycled up to six times before it needs to be disposed of. Over time, the fumes from the transformer oil tend to contaminate the silica gel by blocking the microscopic pores, thus limiting the number of possible regeneration cycles.

Silica gel works as a drying agent because, when examined under a microscope, the material resembles a jumbled pile of tiny silicon straws which draws water vapour into the minute tubes by capillary attraction. The crystals look as if they are solid, but the material is actually a hard porous substance.

The silica gel uses cobalt chloride, impregnated in the silica gel during its manufacture, to provide an indication of how much moisture it has absorbed.

The cobalt chloride forms less than one percent of the silica gel and is normally a deep blue colour when dry, but becomes an almost transparent pinkish colour when it absorbs moisture.

The colour change occurs when the absorption of water modifies the optical characteristics of the silica gel tubes.

Silica gel can be regenerated. By using a breather fitted to a transformer it is possible to determine when the gel should be regenerated.

Usually this is done when the colour change has spread about a third of the height up from the oil bath seal.

The regeneration is done by removing the volume of pink silica gel and spreading it onto a tray, before gently heating the material at a temperature of about 100°C until the crystals or beads have all turned blue again.

If the heat is too intense the trapped water boils off inside the tubes

and causes the tiny straw-like tubes to crack, destroying their ability to absorb water through capillary action. If this happens, the cracked silica gel turns a dirty brown colour and forms powdery particles of dust which, if inhaled, can be carcinogenic.

Silica gel is an important compound for the electrical industry as the volume of oil in oil-insulated transformers expands or shrinks as its temperature rises or falls.

As the conservator air space breathes through an oil bath seal with the changing oil volume, it expels or draws in fresh atmospheric air which could be saturated with moisture.

Transformer oil is very hygroscopic, and without a silica gel breather, absorbed moisture would be drawn from the air into the insulation through the oil circulation.

Moisture would reduce the transformer life through degrading the insulation, and accelerate the formation of a sludge in the oil. Oil bath seals are usually incorporated in silica gel breathers in order to seal off the silica gel from normal atmospheric moisture.

A less expensive form of clear silica gel absorbs moisture in exactly the same way as the self-indicating type. It is widely used in small sachets to keep photographic and electronic equipment dry and free from moisture damage in transit, storage, and between the factory and the end user.

It is also used for packaging shoes, handbags, clothing, the export of motor vehicles, and in rapidly drying flowers to retain their natural colours. The disadvantage of the clear form is that one cannot easily check whether the crystals are dry or saturated.

Silica gel can be hazardous but is actually not toxic – although it may irritate the skin and eyes – but the colour indicator, cobalt chloride, has been identified by the International Agency for Research on Cancer as possibly carcinogenic to humans.

As a result, people handling blue silica gel should always wear a dust mask, protective gloves, goggles or safety glasses, and a covering overall.

Protective equipment is particularly important when the blue silica gel is being, or has been, regenerated, because it may form dust particles which, if inhaled, could result in health risks.

Blue silica gel is classified as hazardous waste under EEC Directive 91/689, which applies to the European Community and although it is not regarded as dangerous for transportation, it is a hazardous waste material and must not be allowed to contaminate soil or water.



Liquid wood may be the basis of a new 'plastic'

Chemists and chemical engineers have long been seeking a substitute for plastics from petroleum and at one stage there was hope that lignin – a natural compound that adds strength to trees – might be a candidate, as it is a waste product from paper production, is biodegradable and abundant.

By the end of the 1990s most work on using the substance had ceased. Now, a German company, Tecnar, says it has invented a formula that allows this liquid wood to be moulded like plastics but, unlike plastics, it will biodegrade over time.

Tecnar's success may revive interest in lignin and propel scientists, chemical engineers and researchers to find cheaper and better bio-plastics.

Tecnar's liquid wood is being sold as Arboform and it is a tough mixture of lignin – at a ratio of more than 50 percent – combined with fibres from wood, flax or hemp. Arboform consists of dark brown, pebble-sized pellets and can be used by machines that currently use plastic raw materials.

The Arboform granules are dropped into a barrel where they are heated until they melt, before being pressurised and forced into a mould and left to cool. As the liquid cools it hardens.

According to Benjamin Porter, a researcher at Tecnar, the material actually conforms to the boundaries of the mould in a more precise and more accurate fashion than most plastics do.

Arboform has a fairly extensive range of products made from this material.

Examples include watches, keyboards, hairbrushes and even coffins. Porter says that future products may include parts used in vehicle interiors and possibly even furniture.

The material has been tested by the Fraunhofer Chemical Institute and, according to chemist Emilia Regina-Inone, it can be recycled between eight and ten times without losing any of its mechanical properties and also offers a relatively high fire-resistance and durability.

At this stage, Arboform is heavier, more brittle and more expensive than conventional plastics. The company sells its products in Australia, Brazil, Colombia and Europe.

Robot surgeons to perform operations on the battlefield

Robots may replace doctors and nurses in real-life battle conditions and a prototype Trauma Pod is already undergoing trials in the United States. The Trauma Pod is like a mini-hospital, manned by robot nurses and surgeons.

The surgeon robot is assisted by 12 robotic nurses, each with a single arm, that is able to pass instruments to the robot surgeon and dispose of used equipment. The Trauma Pod's bed monitors the patient's vital signs and administers fluids and oxygen when necessary.

The purpose of the Trauma Pod is to provide a rapid, quick-fix to soldiers wounded in battle before they are transferred to hospital. According to Pablo Garcia, a project leader at SRI International, the system is intended to provide damage-control surgery, airway control or to relieve any immediate, life-threatening injuries such as a collapsed lung.

The surgeon robot is controlled by a human surgeon some distance away. One of its three arms is used to hold an endoscope so the human controller can see inside the patient, while the other two arms are used to grip and use surgical tools.

The surgeon robot is able to instruct the nurse robots in the vicinity. The robot is also able to carry out certain simple tasks, such as stitching a wound, without human help.

The Trauma Pod is being developed at a cost of \$12-million using funding from the Pentagon's Defense Advanced Research Projects Agency.

The designers of the robots and the Trauma Pod believe they will be able to turn it into a collapsible unit, encased in a shell that can be carried on the back of a vehicle into the heart of the battle zone.

The bed in the Trauma Pod has a single robotic arm that can act as an anaesthetist and insert an intravenous line capable of delivering drugs or anaesthetics to the patient prior to surgery.



A squadron of new unmanned aerial vehicles

The British Ministry of Defence has developed six new unmanned aerial vehicles and these have been showcased at the National Science and Engineering Week – an annual event, which celebrates science, engineering and technology in Britain. Military use of the unmanned aerial vehicles has been growing rapidly and they are now as an integral part of the military arsenal.

The unmanned aerial vehicles are being used by the British forces in Iraq and Afghanistan. The new vehicles include the T-Hawk Micro, which was built by Honeywell and weighs just eight kilograms. It can hover in the sky and uses normal and night-vision cameras to provide troops on the ground with an accurate picture from above. It cost £180 000 to build.

The Watchkeeper is made by Thales and is in active service in both Iraq and Afghanistan. It does not need to be flown by an operator as it chooses its best flight path after the destination has been programmed into it by the operator. It is used mainly to spot improvised explosive devices, and does so by searching for disturbed soil or wires trailing along the ground.

The MQ-9 Reaper is the successor to the well-known Predator unmanned aerial vehicle and the Reaper gives armed forces a larger, faster aircraft that's capable of carrying a larger payload.

It operates at heights up to 15 240 metres and at speeds of up to 390 km/h. It has a payload of about 1,3 tons.

The Desert Hawk III is a smaller version of the Reaper and is a hand-launched drone that is used by troops for surveillance purposes. It fits inside a standard back-pack. It is controlled via a laptop computer carried by a soldier.

The Casper 250 is another small aerial vehicle that can be carried in a back-pack but is powered by batteries, making it silent and invisible from heights above 100 metres.

Two other experimental aircraft are being developed by BAE Systems, the first is a pilotless aircraft known as a Mantis that has a 22 metre wingspan, can run for 24 hours and operates at heights of more than 12 000 metres. The Taranis is a £124-million four-year project to develop an unmanned stealth, deep-strike aircraft that can drop explosives on remote targets. Its maiden flight is expected next year.



Top: The small T-Hawk Micro, weighing less than 8 kilograms is controlled by a soldier on the battlefield from the laptop computer he carries. Centre: The Desert Hawk III that fits inside a standard backpack and allows troops to survey the battlefield. The new Watchkeeper that patrols the skies, looking for evidence of any explosive devices..

Solar powered premiere for

THE AGE OF STUPID

A group of environmentally-conscious people in London decided to screen a new film on the devastating effects of climate change at what is believed to be the world's first solar-powered premiere.

The film, entitled *The Age of Stupid* stars Oscar-nominated British actor, Pete Postlethwaite.

The film was shown in a solar-powered cinema tent in Leicester square and was simultaneously beamed to about 70 other cinemas around the country via a live satellite link. Postlethwaite turned up for the premiere in a solar-powered car, while his co-star, actress Gillian Anderson and designer Vivienne Westwood, both turned up on bicycles.

Even the British Energy and Climate Change Secretary, Ed Milliband, attended the premiere.

In *The Age of Stupid*, Postlethwaite plays the role of an old man living alone in a devastated world of 2055 and spend his time looking back on archive footage of 2008, and keeps asking why no-one acted to prevent climate change when it was still possible to do so?

The film took more than three years to make and had a budget of just £450 000 provided by 228 individual investors. It was officially released in Britain in March.



Humanoid takes to the catwalk at fashion show

A girlie-faced humanoid robot that stands 1,58 metres tall, has shoulder length hair, talks and is controlled by 42 motion motors, will soon be on the catwalks of some fashion shows according to its Japanese developers.

The robot, known as HRP-4C has already performed at the National Institute of Advance Industrial Science and Technology outside Tokyo. The waif-like creature, with slightly over-sized eyes, and a tiny nose, weighs just 43 kilograms including its batteries.

During her performance she was able to strike different poses, flash smiles at photographers and even pout her lips as commands were flashed to her wirelessly from Bluetooth devices. Apparently she did occasionally mix up her facial expressions, but this was blamed on her 'nerves' for the opening performance.

One of the inventors, and head of the humanoid research programme, Shuji Kajita, said that they deliberately used a sliver, metallic body with a robot-like face, because if they had made it too similar to a human being, it would have been uncanny.

The robot was developed mainly for use in the entertainment industry and is currently not for sale. Kajita says that HRP-4C is being used as a stepping stone towards creating a humanoid industry and he emphasised that it is important for people to feel good about humanoids as they may soon have to work alongside them.

The robot had cost about ¥200-million to build and if there were any plans to commercialise production similar robots would sell for about R2-million excluding the outer shell, or the cost of the designer clothing she might insist on wearing.



The Landfill Awards for products that we simply don't need

1



A motorised ice-cream cone holder that is available in three colours and constantly rotates an ice-cream cone for the user has won this year's Landfill Prize for the most pointless, frivolous and wasteful consumer objects made this year.

It is designed for people who are too idle to twist their own wrists when eating an ice-cream and all they need to do is stick in the cone, stick out their tongue and let the machine do the rest. It has a detachable base that can be washed,

specially for those messy eaters who dribble ice-cream down the outside of a cone.

The Landfill Prize is the brainchild of environmental writer John Nash who invited entries from the British public. The entries were judged by Nash and environmentalists Anna Shepard, Carl Honore and Ben Davis.

2



In second place was a cover for airline seats that supposedly will transform a "tired, overused airline seat into a cosy, happy place that keeps at bay germs, crumbs, and spills from previous passengers". The airline seat covers can be monogrammed.

They are available in a Leopard print or in a plain colour and cost \$24,99.

In third place is the utterly ridiculous motorised twirling spaghetti fork that will supposedly make it easier for people with extremely bad co-ordination to pick up a fork-full of noodles and munch them contentedly.



3

However, it takes quite a long time for the motorised fork to gather up the noodles and it is probably quicker to use an ordinary fork or get someone else to cut up the spaghetti for you, so you can eat it with a spoon. The motorised fork costs £5,86 and is available from Amazon.com.

In fourth place is a fisherman's camping chair which, when unfolded, has four loudspeakers built into it so that it can blast music across a river.

An X-ray that will make you blink

An X-ray that is about ten billion times brighter than the sun is being used to examine mummies and other artefacts in the British Museum so that scientists can analyse the composition of the materials. Three ancient Egyptian statues will be among the first objects analysed using this powerful X-ray machine.

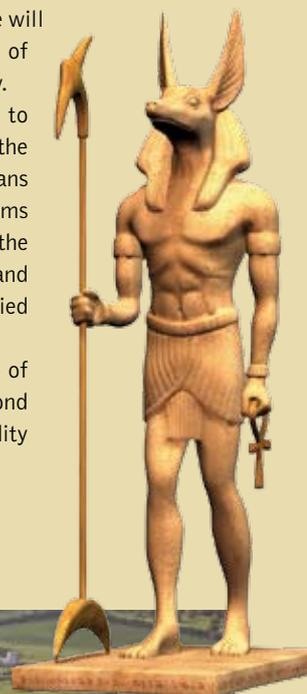
Known as the Joint Engineering, Environmental and Processing (Jeep) beamline, scientists say that it will allow them to better understand the technology and materials used to produce the statues and provide valuable information about the modifications that were performed to these artefacts when they were restored in the 19th Century.

Scientist Jen Hiller, who is based at the Diamond Light Source facility in Oxfordshire says the Jeep beamline will allow archaeologists to reveal the secrets of these ancient artefacts in a non-invasive way.

She believes that scientists will be able to see right inside the statues and even reveal the contents in these artefacts as the Egyptians were notorious for stashing valuable items inside a figure or statue. It will also allow the investigators to see right inside the fragile and sensitive sarcophagi or examine a mummified body beneath the external wrappings.

The Jeep beamline uses intense rays of synchrotron light produced by the Diamond Light Source, a £260-million research facility at Didcot that opened in 2007.

The Jeep beamline is being constructed at the Diamond Light Source in Oxfordshire





Old age starts at 27 say scientists

Scientists have found that old age actually begins at 27 because that is the age when mental powers start to decline, having reached a peak at about 22. Professor Timothy Salthouse, of the University of Virginia says the results of his research suggest that therapies designed to reverse age-related conditions may need to start long before people reach a pensionable age.

Among the interesting findings is the fact that high blood pressure is most often the cause for elderly people not thinking clearly. Furthermore, exercise actually helps to reduce the risk of dementia along with playing computer games, which improve brain power in older adults.

Salthouse's study involved 2 000 men and women and lasted for seven years. The respondents, aged between 18 and 60, were asked to solve visual puzzles, recall words and story details and spot patterns in letters and symbols.

From his study, Salthouse determined that some aspects of age-related cognitive decline starts in healthy, educated adults who are in their 20s and 30s. The research found that in nine out of 12 tests, the average age at which top performance was achieved was 22.

The first age at which performance was significantly lower than the peak scores was 27. The peak scores were taken from three tests for reasoning, speed of thought and spatial visualisation. Memory was shown to decline further from the age of 37 and in other tests even poorer results were shown at the age of 42.

The report also established that abilities based on accumulated knowledge – such as performance of tests on vocabulary or general knowledge – increased until the age of 60.

Watt's Technology

Internet scam student jailed for 19 years

A Nigerian student has been jailed for swindling an Australian woman out of \$47 000 after he was found guilty by the Lagos High Court on 19 charges of obtaining money under false pretences, and forgery. The criminal charges were brought against him by the Economic and Financial Crimes Commission.

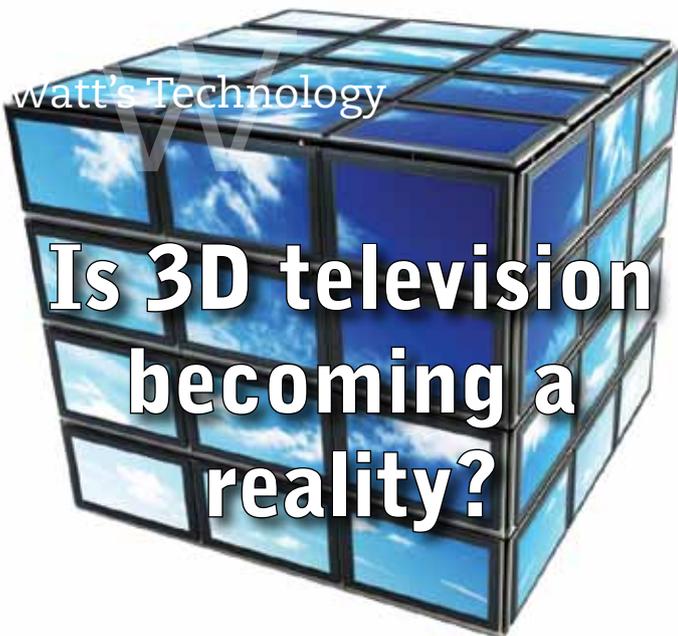
The 29-year-old student at University of Lagos, Lawal Adekunle Nurudeen, met an Australian woman over the Internet in 2007 and introduced himself as Benson Lawson. He claimed to be a British engineer working for a multi-national company on contract in Nigeria.

The woman, who was 56, told her Internet buddy that she was looking for a husband and hoped to meet someone on the Internet. Nurudeen, who is actually married and has three children, suggested he might fit the bill, claiming that his wife had died a few years ago.

Then, as part of the scam, Nurudeen called the Australian woman and introduced himself as a doctor who was attending to Lawson. He told her that her "fiancé", Benson Lawson, had been involved in a serious accident and needed money for his treatment.

The love-struck woman immediately agreed to send some money, which she did. About two weeks later, Nurudeen again called the woman, this time posing as Lawson, suggested that he should visit her in Australia to meet her and consummate their relationship. He told her that he did not have enough money for the ticket because of his medical expenses. She sent him more money.

In terms of the court's findings, Nurudeen has been jailed for 19 years and has been ordered to repay the \$47 000 he swindled from her.



Is 3D television becoming a reality?

Television manufacturers around the world are spending enormous amounts of money on developing television sets that can display all three dimensions that you see in real life without necessarily having to wear glasses to create the 3D effect.

Panasonic has made a 103 inch (262 cm) prototype 3D television set, which it launched in Amsterdam earlier this month. Panasonic showed footage from last year's Olympics with scenes from a football match that were so realistic viewers actually ducked as a soccer ball flew past them.

Panasonic uses high-definition Blu-ray technology for its 3D system. Importantly, the company is hoping to bring all the television manufacturers and the different Hollywood studios together so that they can work together to devise a common, open, technical standard that will be crucial for the success of 3D television.

The Panasonic system offers full high-definition resolution to create the 3D effect but says that this was achieved with "just a minor tweak" of existing technologies.

Sky Television – along with many other broadcasters around the world – is throwing its full weight behind the project to develop broadcast quality 3D television and claims that viewers in Britain will be able to watch the 2012 Olympics in full 3D, broadcast from the stadiums around the UK.

Movie studios, too, are investing in the new 3D technology with the Disney movie *Bolt* being shot in 3D while the forthcoming releases of *Shrek Goes Fourth* and *Toy Story 3* will also get 3D treatment.

Electronics company, Philips, has shown off its prototype WOWvx television that produces a 3D image that can comfortably be viewed from a variety of positions and angles by fitting a lenticular lens over the TV's LCD panel. These screens do not require the viewer to wear glasses to get the 3D effect, which can be viewed from any position in a room.

The difficulty of filming in 3D poses additional problems for broadcasters and film producers. Filming a sporting event in 3D, for instance, means that two cameras must be placed close to each other, to mimic the alignment of a human's eyes.

The two cameras will have to be installed at each one of the different camera positions used at a sporting event, making it a costly and technically complex exercise.

Dumping old equipment is a real problem

Africa has become a dumping ground for electronic and electrical waste (e-waste) generated by many First World countries, and in South Africa, many municipalities are still accepting consumer electronic equipment, white goods, rechargeable batteries and cell phone handsets at the landfill sites.

According to the e-Waste Association of South Africa, white goods such as refrigerators, microwaves and stoves are likely to make up most of the e-waste being dumped in this country. However, in a recent undercover operation,

Greenpeace tracked an irreparably-damaged television set, which was supposed to be recycled in Britain, to a shop in Nigeria where it was disguised as second-hand goods.

One of the major problems with e-waste, is that it exposes vulnerable communities, living on or near landfill sites, to highly toxic chemicals such as mercury, which can cause brain damage, lead, which can damage reproductive systems, and cadmium, which causes kidney damage.

Europe, the United States and South Korea are already using developing countries such as Nigeria, Ghana, Pakistan, India and China as e-waste dumping grounds.

According to e-Waste's national co-ordinator of research and development, Lene Ecoignard, South Africa is not yet a target country for dumping and most of the e-waste processing is done by private sector companies anyway.

Scrap metal recycling of white goods remains a lucrative resource for some companies, along with reconditioning of personal computers for use in schools in disadvantaged communities.

According to Ecoignard the recycling challenges that currently face South Africa are:

- How to deal with cathode-ray tube glass, finding markets for flame-retardant plastics and disposing of liquid crystal displays;
- Formulating environmentally-friendly ways of disposing of rechargeable batteries used in electronics;
- Enforcing health and safety regulations among recycling companies;
- Enforcing environmental protection measures at recycling companies.



Electron microscope for nanotechnology

Scientists in South Africa will have access to a High Resolution Transmission Electron Microscope (HRTEM) at the Nelson Mandela Metropolitan University in the Eastern Cape. It will cost about R80-million to install the microscope and its control and supporting systems.

The HRTEM will have aberration-corrected lenses and will be able to analyse samples in addition to capturing images of them. It will be able to resolve individual atoms (appearing as spheres) and distinguish the nucleus from the electrons. It is apparently one of the most advanced microscopes of its kind in the world.

The programme to build the new National Centre for High Resolution Transmission Electron Microscopy is being undertaken by the National Research Forum, which falls under the Department of Science and Technology.

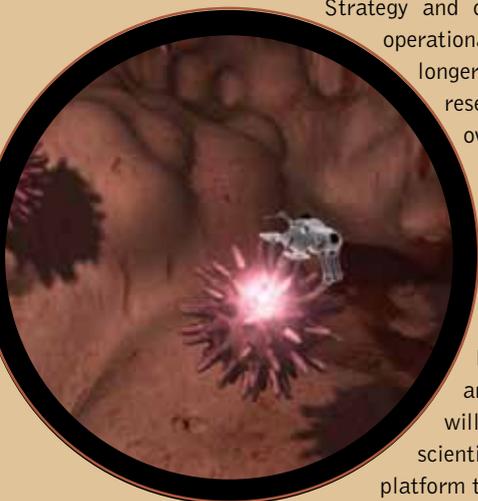
It has the support from a number of South African companies including Sasol, the Nuclear Energy Corporation of South Africa, Pebble Bed Modular Reactor (PBMR) and Element Six, part of the De Beers' group.

According to the Department of Science and Technology, the creation of the new centre and the purchase and installation of the HRTEM are in line with the country's National Nano-technology

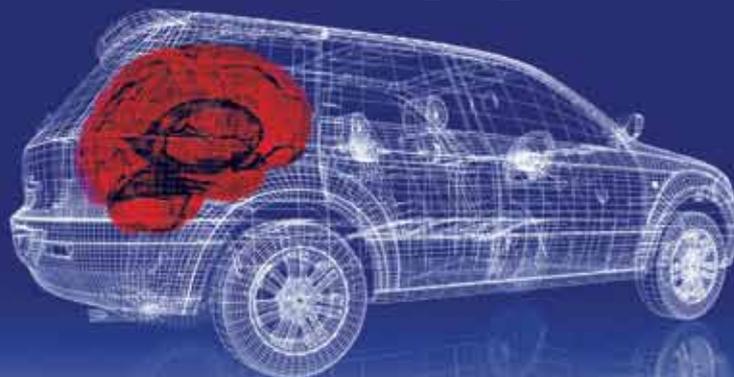
Strategy and once the HRTEM is fully operational, local companies will no longer need to do much of their research and development overseas.

The instrument is likely to be fully operational by 2011.

Three companies are bidding for the project including Netherlands-based FEI, Jeol of Japan and Germany's Zeiss. It will provide South African scientists and researchers with a platform to develop nanotechnology.



Watt's Technology



A slow drive that's oh, so safe

A new technology, known as Sentience, can be fitted to cars in Britain to reduce the number of speeding tickets motorists might get in a year and also reduce the amount of fuel used over the same period.

Sentience uses digital road maps, stored in an on-board computer, to adjust the speed of the car, to slow down for obstacles such as speed humps and stop at red lights or stop streets.

By anticipating the slowing down and stopping procedures, the Sentience minimises fuel wastage and increases the life of the brakes and the tyres.

To use the system, a driver will enter the postal code of the destination and the Sentience will select the optimal route and speed based on the global positioning system information it receives. The driver is required to steer the vehicle but all other controls are handled by the on-board computer.

According to Tom Robinson, leader of the Sentience project, the system will save at least £500 a year for a motorist who currently spends about £50 a week on fuel.

He did concede that the journeys were likely to take longer because of the cautious driving style the Sentience system adopts.

Apparently hybrid vehicles, which use a combination of petrol engines and electric motors, offer the greatest potential for savings. The Sentience system has been fitted to a Smart where it has proved that it can increase tyre life, decrease the wear on brakes, improve fuel economy and stop the driver from getting a speeding ticket.

Some rocks love carbon dioxide

Scientists have identified certain rocks along the east and west coasts of the United States that may be able to absorb carbon dioxide gases at a rate that is sufficient to slow climate change.

Rocks are known to absorb carbon dioxide over thousands of years by binding it with minerals to form calcium carbonate, commonly found in rocks as well as in snail shells and eggshells.

When the surface of a rock is dissolved through weathering, the rock absorbs carbon dioxide from the atmosphere as it recrystallises and scientists have been able to speed up this process in the laboratory by grinding rocks and adding a catalyst such as sodium citrate to dissolve them. The rocks then re-form in minutes by absorbing carbon dioxide.

The problem is that while this can be done in a laboratory, it occurs on too small a scale and requires too much energy to tackle in the natural environment.

So scientists are trying to identify natural rock outcrops that could be forced to absorb carbon dioxide by drilling into a rock and injecting it with hot water and pressurised carbon dioxide.

If it works it might be a more viable alternative to permanently storing carbon dioxide underground in large storage tanks.

Moreover, scientists have now identified a 15 540 square kilometre area that has rocks rich in olivine and serpentine, which could also be used to absorb carbon dioxide.



These rocks lie on or near the surface in California, Oregon and Washington and along the entire Appalachian belt of eastern North America, from Alabama to Newfoundland.

Similar rocks are abundant in Oman, the Pacific Islands of Papua New Guinea and Caledonia and along the coast of the Adriatic Sea.

Scientists believe that rocks in the US alone could absorb about 500 years of carbon dioxide emissions. However, they have not given any indication of how long it would take to get the rocks to actually absorb that amount.

Satellite sinks off Antarctica after launch failure

The satellite was supposed to map the global distribution of carbon dioxide and study how it changes over time in what was meant to be the Orbiting Carbon Observatory. An investigation panel has been formed to determine the probable cause of the failure.

However, Brunschwyler says that all stages of the rocket ignited and burned so the toxic hydrazine fuel would pose no danger to marine life in the Antarctic region.

The satellite that is now lying at the bottom of the ocean took eight years to build and was Nasa's first spacecraft dedicated to studying carbon dioxide. Earlier this year Japan launched the world's first satellite dedicated to monitoring greenhouse gas emissions in the earth's atmosphere.

The Japanese mission will allow scientists to measure the density of carbon dioxide and methane surround the earth.

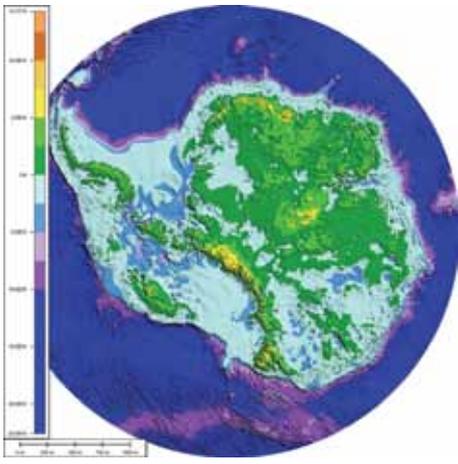
These measurements will provide governments with useful data as different countries come under increasing pressure to meet the 2008-2012 Kyoto Protocol goal of cutting greenhouse gas emissions.



A satellite that was meant to monitor carbon dioxide emissions in earth's atmosphere has failed to reach its orbit and has plummeted back into the ocean near Antarctica in what the National Aeronautics and Space Administration calls a major disappointment for climate scientists around the world.

The satellite was launched from the Vandenberg Air Force Base in California aboard a Taurus XL rocket but minutes after lift-off a nose cone fairing, which protects the satellite during the launch, failed to separate from the rocket.

According to John Brunschwyler, programme director for the Taurus rocket at Orbital Sciences Corporation the vehicle did not have enough lift to reach orbit and fell back to Earth. It was the first time that NASA had used the Taurus rocket.



New 'Alps' found under the ice in Antarctica

A mountain range that is about the size of the French Alps has been discovered three kilometres below the ice in Antarctica. The range has been named Gamburtsev and was found after researchers flew aircraft for 120 000 kilometres to map the range. The range is about 250 kilometres wide and 700 kilometres long.

The scientists had predicted that they would find a large, flat plateau under the ice and were astounded when they discovered the massive peaks as high as Mont Blanc, and deep valleys between the mountains.

Water that had turned to liquid because of the pressure from the East Antarctic Ice Sheet above could be seen in rivers and lakes nestled in the valleys between the mountains. One lake, the Vostok, is about 300 kilometres in length – about the same size as Lake Ontario.

Scientists hope that the study of the regions below the ice sheets will aid them with predictions about the effects of climate change and possibly challenge the long-held view that ice sheets were formed millions of years ago.

The new research suggests that the ice formed in a fraction of time and the Antarctic region could have been ice-free at some time in the past. The scientists say that the ice may have formed as a result of a sharp fluctuation in the global temperature.

The research was conducted by a team of scientists, engineers, pilots and support staff from seven nations working in Antarctica's Gamburtsev Province.

They used state-of-the-art radar and aeromagnetic and gravity sensors to map the one-million square kilometre region under the East Antarctic Ice Sheet.

Langrangian Points may harbour grave dangers

Scientists are slightly concerned that a "ticking time-bomb" in the form of an asteroid may be lurking in the area of the universe known as the Langrangian Points where the gravitational pull of the earth cancels out that of the sun, causing objects to become weightless or remain suspended.

Apparently the Langrangian Points are extremely large, but scientists are not sure what they actually contain. Richard Gott, from Princeton University, who has been researching the Langrangian Points, says that they could hold a number of large and possibly lethal asteroids.

He says the gravitational pull of other planets – in particular Venus – could drag any one of the asteroids away from the equilibrium of the gravitational pull, releasing it into the universe.

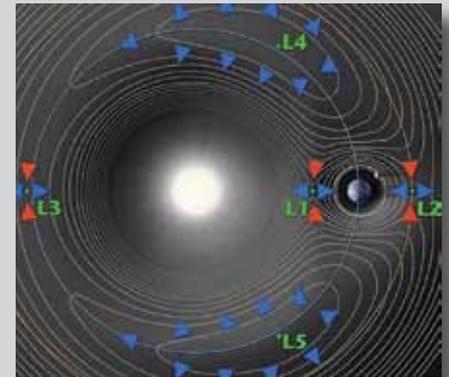
From there, an asteroid could quite easily be drawn into a collision course with earth.

Two spacecraft from NASA's Solar Terrestrial Relations Observatory will reach designated points, L4 and L5 later this year where terrestrial bodies in the Langrangian Points can be more accurately assessed and observed.

The area is enormous and it will take months for the probes to cross the Langrangian Points.

Gott believes that if scientists spotted an asteroid on a collision course with the earth they might recommend that the military take pre-emptive action by blowing it to pieces.

However, until now the prospects of blowing up an asteroid, or even a meteorite, have proved to be more fiction than reality but scientists are said to be working on ways to deflect or detonate an asteroid that is on a collision course with earth.



A contour plot of the effective potential of a two-body system (the Sun and Earth here) due to gravity and the centrifugal force as viewed from the rotating frame of reference in which Sun and Earth remain stationary.

Obama's \$10-billion stimulus for smart technologies

Electricity grids could be made a lot smarter and a lot more efficient according to scientists who are working at the IBM laboratory in Texas. Scientists throughout the United States have been promised a large chunk of President Barack Obama's 'stimulus' cash to develop a more efficient power delivery system that is also environmentally friendly.

According to Drew Clark, director of strategy at IBM's venture capital group, Obama has promised to provide \$10-billion to smart energy technologies and nearly half of that money is designated for power grid innovations.

In fact, the laboratory at IBM's campus in Ausin looks more like the set for a television 'soapie' than a serious research facility. It has a mannequin lying on a bed in a mock hospital room that is equipped with sensors that a capable of detecting the presence of doctors, providing these doctors with details about the patient's condition and even being able to detect if the medical personnel have washed their hands before starting treatment on the patient.

Nearby, in other rooms, are the recreations of a living room, a kitchen, a cafe, and a utility control centre.

Each of these rooms is fitted with sensors to enable devices that will anticipate the needs of the people who enter the rooms. It switches off lights when no one's around, turns them on when someone enters, controls fridges, kettles and other kitchen equipment and so forth. The entire process is aimed at saving electricity and preventing wastage of energy.

According to the Solutions Experience Lab's architect, Jeff Mausolf, who plays the part of a working in the utility control centre, he can, with a few taps of the computer keys, he can remotely change a thermostat setting in a home with central heating or turn off power-gobbling airconditioners in an office block.

Apparently much of the smart grid technology is already being used in Austin.

Google has also joined in the energy saving processes as it announced refinements to its PowerMeter software that will tell residents in any home in the US what amount of energy they are consuming at any time of the day.

Obama's stimulus package is aimed at curbing excessive use of electricity and making energy usage much more efficient.

Added to these efforts, are the billions of dollars earmarked for putting up new power lines, switching to solar power generation or erecting viable wind farms.

According to Clark, the current cost of wind energy is on a par with the costs of generating energy from coal-fired power stations and, with refinements in the solar energy methods, this source of energy is also getting cheaper by the day.

The US is not the only country that is working on smart grid technology and Malta awarded a contract to IBM to build an intelligent infrastructure of control both electricity and water consumption in that country.



Pluto's upper atmosphere warmer than its surface

Pluto, one of the odd celestial bodies in the solar system and one that has recently been declassified as a planet, apparently has an upside-down atmosphere with temperatures rising, rather than dropping, as they reach higher altitudes.

Astronomers have recently made detailed measurements of the concentration of methane gas in Pluto's atmosphere using the European Southern Observatory's Very Large Telescope. The measurements show that methane is the second most abundant gas in Pluto's atmosphere and that the gas actually gets warmer as it rises to high elevations.

Researchers found that the upper atmosphere around Pluto is about 50 degrees C warmer than the icy surface that is coated with frozen patches of methane and other gases. As Pluto orbits the sun, the frozen gases vaporise cooling Pluto's surface but warming the planet's atmosphere.

NASA has sent its New Horizons probe to Pluto and this probe will settle into orbit in 2015.

According to Leslie Young, deputy project scientist working on the New Horizons probe, the combination of the earth-based observations and the New Horizons data from Pluto's orbit will provide an insight into the dwarf planet's behaviour as it circulates around the sun.

Pluto is now classified as the largest member of the Kuiper belt – a huge region 200 times as massive as the asteroid belt that comprises frozen volatiles or ices, formed from frozen gases such

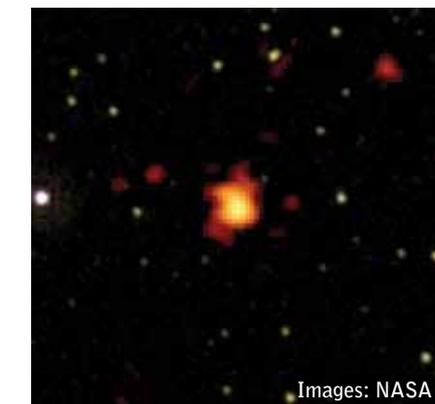
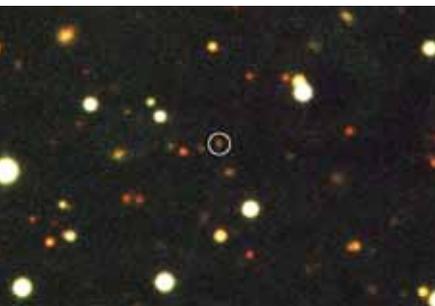
as methane, or ammonia.

Pluto is just 20 percent of the mass of earth's moon and has a highly inclined and highly eccentric orbit around the sun.

Pluto, and its largest moon Charon, are treated as a binary system because the barycentre (a point between two objects that balance each other) of their orbits does not lie within either body.

In 2006 the International Astronomical Union defined the term planet and this definition excluded Pluto which was reclassified as a dwarf planet along with Eris and Ceres. Ceres is part of the asteroid belt but is not dominant within it just as Pluto is part of the Kuiper belt without being dominant either.

After reclassification, Pluto was added to a list of minor planets and given the number 134340. A number of scientists still believe that Pluto should be classified as the ninth planet of our solar system.



Images: NASA

Gamma ray blasts the biggest yet seen

A gamma ray blast equivalent to the power of 9 000 exploding stars has been found in the deep-space constellation of Carina by scientists working on NASA's Fermi Gamma-ray Space Telescope project. The radiation burst occurred about 12,2-billion light years away and it's only being seen by people on Earth now.

Gamma ray bursts are the most luminous of the explosions in the universe and scientists believe that they may occur when massive stars collapse in on themselves to form a black hole. The jets of material that blast outwards at virtually the speed of light are powered by the explosive processes that are not yet fully understood.

The new explosion, known as GRB080916C was spotted last year and scientists calculated that

the material emitting the gamma rays must have been moving at 99,9999 percent of the speed of light. Apparently the explosion was particularly spectacular because of a curious time delay that separated the highest-energy emission from the lowest.

Scientists cannot explain what caused the time delay but believe it may have been as a result of physical factors or may have been caused by some peculiar quantum effect. Burst emissions at these energies are still poorly understood by scientists because few of the bursts have been studied.

However, astronomer Peter Michelson says that as the Fermi Gamma-ray Space Telescope captures more information it will help scientists understand the cause, extent and frequency of gamma ray bursts throughout the universe.

Trees keep sucking up billions of tons of greenhouse gases

Climatologists and scientists have found that 20 percent of all climate change emissions are absorbed by rain forests and jungles around the world, providing further compelling evidence that measures to halt rapid deforestation must be found.

According to the new research studies conducted in the tropical forests of Africa, 4,8-billion tons of carbon dioxide are converted to oxygen by trees and each hectare of intact African forest can trap about 0,6-tons of carbon in a year.

Dr Simon Lewis, a Royal Society research fellow at the University of Leeds says that tropical forest trees are absorbing about 18 percent of the carbon dioxide in the atmosphere each year and this is buffering the rate of climate change affecting the world.

The Intergovernmental Panel on Climate Change has estimated that

human activity emits 32-billion tons of carbon dioxide each year but only 15-billion tons remain in the atmosphere. The research clearly indicates that trees in tropical and rain forests are responsible for reprocessing some of the 'missing' 17-billion tons of carbon dioxide emissions.

Lewis says that the value of the rain forests and the tropical jungles is immense and because of this urgent measures to stop deforestation must be implemented worldwide. However, deforestation in Africa is proceeding at an alarming rate mainly because much of the timber is either exported or the lands are cleared for agricultural purposes.

Lewis says that it is imperative for countries throughout the world to implement sweeping cuts in greenhouse gas emissions as this will help to stop the major pollution levels that are contributing to global warming and climate change.

Toyota wants to build a seaweed car

Toyota is working on producing a super-efficient, plug-in hybrid vehicle with a bio-plastic body made from seaweed. It is hoping to have the car ready for sale within the next ten to fifteen years. Many vehicle manufacturers are investigating bio-plastic materials produced from natural materials such as seaweed.

Demand for bio-plastics is expected to grow to about 23-billion kilograms annually within the next five years, equivalent to about ten percent of the world's market for plastics. The bio-plastics are being used to make mobile phone cases, gift cards and many other consumer products.

According to analytical company NatureWorks, bio-plastics produce 60 percent less carbon dioxide and require 30 percent less energy than petroleum-based plastics.

Toyota is hoping to use bio-plastics in its 1X plug-in hybrid which is currently made from carbon-fibre reinforced plastics. The concept car weighs just 420 kilograms and is powered by a 500 cubic centimetre engine, supplemented by an electric motor that draws power from its lithium-ion batteries.

According to project manager, Tetsuya Kaida the 1/X (pronounced one-Xth), the interior space of the concept car is equivalent to that found in the Prius and yet it weighs less than a third of the other vehicles in its class.

The engine burns a mixture of ethanol and petrol and designers hope this will allow them to achieve more than twice the fuel economy of the Prius while lowering carbon dioxide emissions. The engine in the 1/X is mounted midships, under the rear seat, and drives the rear wheels. The batteries can be recharged from a normal plug.





100 000 000 000 000 000 000 000 Earths?

There are estimated to be about a hundred-billion-trillion Earth-like planets where life could exist according to Alan Boss, an astronomer at the Carnegie Institution in Washington DC and, because of this, he says that it is inevitable that life must have flourished elsewhere in the universe.

The National Aeronautics and Space Administration's Kepler space-based telescope is being used to extensively search for planets that show some signs of being habitable, and scientists are confidently predicting that within the next four years they will find evidence of life elsewhere in the universe.

Boss says that once evidence of life has been found, then it is possible that an unmanned spacecraft will be sent to the planet that

could be up to 30 light years away from Earth. The predicament with such an unmanned exploration is that it could take up to 2 000 years before any information is received back on Earth.

Boss believes that the likelihood of finding an inhabited planet populated with intelligent life is also inevitable but adds that intelligent life seems to be rather fleeting as it only exists for a fraction of time rather than for billions of years. This, in Boss's opinion, suggests that it would be an amazing coincidence for humans to find intelligent life existing elsewhere at the same time.

Says Boss: "It is unlikely that the human race will exist 100 000 years from now and in space terms that's just a fleeting moment." Human life is believed to have been on Earth for only 65 000 years.



Forget the cricket – Australia and South Africa are partners

Australian and South African researchers, scientists and astronomers are co-operating to develop the Square Kilometre Array (SKA) radio telescope even though the two countries are competing to host the project. Already, E150-million has been committed to the project by the governments of Australia and South Africa.

Professor Richard Schilizzi, international director of the SKA project, confirmed that the European Union has also confirmed its support for the project that will see 3 000 receiving dishes, each 12 to 15 metres across, being built in South Africa or Australia. The radio telescope will pick up radio waves rather than light waves and would be 50 times more sensitive than any similar telescopes.

Scientists plan to use the SKA radio telescope to study emissions generated when the first stars and galaxies were formed, about 750-million years after the 'big bang', that gave birth to the universe some 14-billion years ago.

The SKA radio telescope will be built at a cost of E1,9-billion and 40 percent of the funding will come from the United States while eight European countries – Britain, France, Germany, Italy, the Netherlands, Portugal, Spain and Sweden will share a further 40 percent of the costs.

A decision on where to host the SKA radio telescope will only be taken in 2011 or 2012 and construction is only scheduled to start in 2013. It will take three years before the radio telescope starts operating and it will only be fully operational by 2021.

The two sites earmarked for the SKA radio telescope are in the Northern Cape in South Africa with outstations in eight other African countries, or in Australia's Outback, with one outstation in New Zealand. So far 19 countries have indicated their support for the project and 55 academic and scientific institutions have joined it as well.

Meanwhile, South Africa is going ahead with construction of its own Meerkat radio telescope in the Northern Cape while Australia is building its Murchison Radio-astronomy Observatory in a remote part of Western Australia.



Multi-ply toilet paper causes more damage than a Hummer



Can you believe that those extra-soft, quilted, multi-ply toilet rolls that people insist on buying could be more damaging to the environment than a gas-guzzling Hummer vehicle. At least that's what Allen Hershkowitz, a senior scientist at the Natural Resources Defence Council says.

The problem is that multi-ply toilet paper is made from virgin wood and uses chemicals to make the pulp needed to produce the paper. More than 98 percent of the toilet paper rolls sold in the United States comes from virgin forests while in Europe and Latin America, about 40 percent of toilet paper uses recycled products.

Greenpeace feels so strongly about Americans using multi-ply, super-soft toilet paper that it has made a cut-out-and-keep guide that ranks individual toilet paper products based on the ecological damage they cause.

Hershkowitz says that recycled multi-ply toilet paper can be as soft as the products made from virgin forests and has called on toilet paper manufacturers such as Kimberley-Clark, to start using recycled products.

Toilet paper is big business in the US and the New York Times reported a 40 percent rise in the sales of luxury brands of toilet paper at a time when the world is facing a global economic melt-down and President Barack Obama has just released \$963-billion to support the economy.

Kimberley-Clark is about to release a new range of toilet paper rolls infused with hand lotion, which is sold as a luxury, premium, high-priced option for discerning buyers.

According to Kimberley-Clark spokesman Dave Dixon, toilet paper and toilet tissues made from recycled fibre have been available on the market for years but Americans do not buy the products. He says the longer fibres in virgin wood are easier to lay-out and fluff-up to give the toilet paper that super-soft, quilted feeling.

Americans are the world's largest paper consumers, using three times more than the average European and about 100 times more than the average person in China. Barely a third of paper products sold in America comes from recycled sources.

Sunscreen for Earth using trillions of mirrors?

Scientists believe they will be able to halt global warming by firing trillions of mirrors into space to deflect the sun's rays and create a 160 000 square kilometre sun shade.

According to astronomer, Dr Roger Angel of the University of Arizona, the trillions of mirrors would have to be fired to a height of about 160-million kilometres above the earth using a huge cannon with a barrel that is almost a kilometre wide.

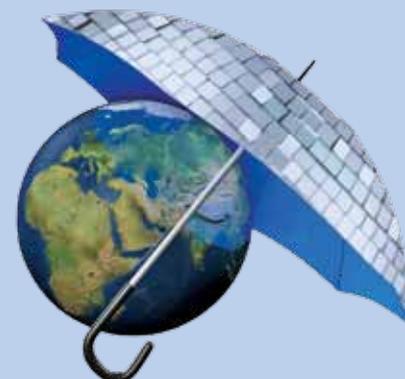
He says the cannon would need about 100 times the power of conventional weapons and need an exclusion zone of several kilometres before it could be fired. The project would cost about \$350-trillion. Angel says that while various tests will be needed the sun shade will be "ready to launch" in about 20 or 30 years from now.

National Aeronautics and Space Administration has provided funding for a pilot project and British inventor, Tod Todeschini has been commissioned to build a scaled-down version of the gun. He has already built a four-metre long cannon at his workshop in Oxfordshire for a television documentary and admits that it is dangerous.

He was attempting to build a gun with about 1 500 Gs of force but it ended up creating about 10 000 Gs so it had to be extensively modified. Todeschini says the main danger was being electrocuted because it used enough electrical power to boil 44 000 kettles.

Angel says the mirrors he plans to use will last at least 50 years before being replaced and that means that fresh lenses will have to be fired into space to keep the shield constant. However, Angel believes that the sun shade project would protect the earth for centuries.

Researchers at the University of Victoria in Canada are testing the sun shield theory using computer simulations of the project.





Use some methanol to recharge your cell phone?

Sony has made a methanol fuel-cell that can recharge a lithium-ion battery to recharge a cellular phone, an MP3 player or any one of a number of electronic devices. Sony has also built a set of hybrid, cordless stereo speakers, which could be powered for a full year using a single bottle of methanol fuel.

The prototype cell phone charger comes in two models, a small, portable unit that can be used anywhere and a heftier home model for larger devices. The system enables either one of the chargers to intelligently switch from drawing power from the battery to using the methanol fuel cell or, in high demand conditions, using power from both sources.

The portable charge has a USB port to supply power to an electronic gadget and is equipped with a leatherette lanyard, making it easy to carry anywhere. Apparently the larger home charger with two USB ports can provide power for a cell phone for an entire month using a single methanol fuel cell.

Sony's prototype wireless speaker system has been fitted with a methanol fuel cell and lithium-ion batteries to provide a constant source of power. There is a strobe light fitted on top of the speakers as well. Apparently a single methanol fuel cell will provide enough power for the wireless speakers for a year under normal playing conditions.

The prototypes were demonstrated at the Fuel Cell Exhibition held in Tokyo in February this year.

Bankrupt Iceland wants to convert to hydrogen?

First Iceland tried to turn itself into a banking nation by raising \$100-billion to finance foreign acquisitions – even though it has a gross domestic product of just \$14-billion. Then, it had to nationalise its three largest banks, Kaupthing, Landsbanki and Glitner which were defaulting on a \$62-billion loan for foreign investors.

As a result of the economic mess, Iceland's government collapsed, there were mass demonstrations and thousands of people were faced with huge personal losses. European countries, the International Monetary Fund and other international investors agreed to help the country find its way out of the economic quagmire.

Having failed rather dismally as bankers, Icelanders now want to convert to a hydrogen economy. It currently has just 14 hydrogen-powered vehicles in the whole country but it says it will become a hydrogen-based economy and will use no fossil fuels by 2040.

According to Jon Bjorn Skulason, general manager of Icelandic New Energy, the country will not need to import fuel from foreign sources as it will be one hundred percent sustainable using alternative energy including electricity from hydroelectric and geothermal plants and hydrogen.

While there are only 300 000 people living in Iceland, they have harnessed melt-water from massive ice sheets and steam from the many



volcanoes that dot the landscape to generate electricity. In mid-Winter, Icelanders use geo-thermal heat to grow bananas in greenhouses and to warm the streets and sidewalks of central Reykjavik. Maybe they have some useful experience in using alternative energy.

Already Iceland engineers have built a fuel-cell-equipped whale-watching vessel, the Eiding and its captain Vignir Sigursveinsson, uses the fuel cells to power the ship's electrical systems allowing him to shut down the diesel engines altogether when observing whales.

At the moment, Iceland has just one hydrogen filling station in the entire country. Be that as it may, Iceland remains confident it will lead the world by being independent of fossil fuels within 30 years.

Of course it may also be true that Iceland once thought it would lead the world's banking community into a new age? I suppose we'll just have to wait and see.

Farmers using methane to provide energy

By using a combination of manure and slurry made from waste organic materials, enough energy could be generated to heat more than two million homes in Britain, according to the Department for Environment, Food and Rural Affairs (Defra).

It has launched a programme to produce energy from anaerobic digestion plants, which generate gas as the organic material is broken down in an oxygen-free environment. Researchers working for Defra estimate that about 100-million tons of organic material could be used to produce 90-million tons of biogas, using a combination of methane-rich organic slurry, combined with manure from farm animals.

The National Farmers' Union in the UK plans to have about one thousand anaerobic digestion plants running on farms around Britain by 2020. These plants will provide energy for the farms themselves and, as a by-product, will provide a fertiliser that can be used on crops.

According to Farming and Environment Minister, Jane Kennedy, Britain produces over 12-million tons of food waste a year - excluding the organic waste from food crops - and instead of sending this material to landfill dumps, Kennedy says, it should be used in anaerobic digestion plants to make biofuels.

The anaerobic digestion plants use bacteria to break down organic matter and manure in the absence of oxygen and, during this process, produces biogas that can be used for heating or to generate electricity.

In a separate development, a dairy in California has converted a pair of 18-wheeler trucks to run on bio-methane extracted from cattle dung. These trucks are believed to be America's first dung-trucks.

Hilarides Dairy, produces about 6 400 cubic metres of methane from the 10 000 cows on its farm. The dung from each one of the cow stalls is shovelled into a covered lagoon where bacteria break it down, producing methane. The methanol is pumped to a nearby refinery where carbon dioxide, hydrogen sulphide and other impurities are removed.

The purified methane is pressurised before being pumped into the trucks. The Cummins diesel engines have been converted to spark-ignited methane burners.

The project cost the Hilarides Dairy \$600 000, but the cash for the project was funded by a grant from the California Air Resources Board's Alternative Fuel Incentive Program.

Using cow dung to produce bio-methane apparently cuts greenhouse gas emissions in two ways: burning bio-methane produces less pollution than burning conventional fossil fuels and by producing bio-methane from manure less methane gas is released into the atmosphere by the dung itself.

Jatropha biofuel project for Mozambique

Investors and government authorities in Mozambique have been working on plans to produce biofuel from jatropha beans, which contain oil levels of about 40 percent, for some years and the Energy Minister, Salvador Namburete, says the biofuels project is likely to be approved by government within the next month.

Conditions in Mozambique are apparently ideal for growing jatropha plants and, as it is a non-food crop, it is ideal for biofuel production. It can be grown in semi-arid land. Government authorities in Mozambique have apparently received requests to open up five-million hectares of land for the production of biofuels.

Almost two years ago the government approved plans for a \$510-million ethanol production facility being built by British-based Central African Mining and Exploration Company. It will use sugar-cane as the feedstock to make ethanol.

In addition, Principle Energy, a renewable energy company, will start building a \$290-million bio-ethanol plant in Mozambique later this year. Namburete has not given any indication when the jatropha project may get underway, other than to say that the strategy for the production of biofuels from this crop, will be approved soon.

Mozambique is investing heavily in energy production and is going ahead with its \$3-billion Moatize Thermal power station, the \$8-

billion OilMoz refinery, being built in the southern part of Maputo, the \$2-billion Mpanda Nkuwa dam on the Zambezi and the \$5-billion Ayr Petro-Nacala refinery project being built at the port city of Nacala in northern Mozambique.



Eskom planning third coal-fired power station?

South Africa has an abundance of sunlight and wind and because of this, a combination of solar, thermal and wind energy would be the most cost-effective solution to this country's energy problems, claims Richard Worthington, climate change programme manager for the World Wildlife Fund.

Currently South Africa depends on coal for more than 90 percent of its electricity generation although it is hoping to generate about 15 percent of its electricity from renewable sources by 2020. So far, only one wind farm, capable of generating just 100 MW of power is operational in the country.

South Africa has appealed to the United Nations for funding so that it can develop environmentally-friendly technologies for electricity generation. Worthington warns that unless South Africa does adopt environmentally-friendly electricity production methods, it could run the risk of being penalised on international markets because the products being exported are made using 'dirty' energy.

In spite of this, Eskom has confirmed that it will press ahead with its investigations into building a third new-generation coal-fired power station. Eskom's chief officer: generation, Brian Dames, says Eskom is pressing ahead with its investigations to identify a suitable new coal field, design a new power station and undertake the mandatory environmental and regulatory studies.

He says Eskom is also prioritising its Independent Power Producer (IPP) programme so that it can spread the project funding risk. Bids and projects from IPPs are currently being evaluated by Eskom.

The utility is currently working on the return-to-service projects at the Gas One power station in the Western Cape and the Ingula pumped-storage scheme in KwaZulu-Natal. It is also building two giant new power stations at Medupi in Limpopo and Kusile in Mpumalanga.

Dames says that because electricity demand is currently well below the 30 000 MW daily level, the summer maintenance programme has been progressing at an accelerated pace without causing disruptions to the electricity supply.

Dames expects marginal or zero growth in demand for electricity this year but warns that the future demand is unclear. However, he emphasised that Eskom will not actually need to double its generation capacity by 2025 as demand is expected to peak at between 60 000 MW and 70 000 MW by that date.

Eskom is currently spending R343-billion on its return-to-service projects and its two new power stations.



Australia starts printing solar cells

Sophisticated printing presses that are normally used to produce Australian dollar bills are being used to make solar power cells as part of a test conducted by a printing company in Melbourne. The presses arrange and stamp flexible solar panels onto a thin plastic film.

Results from the test show that the cells are only three percent efficient, meaning that they can convert only small amounts of solar energy into electricity but the Commonwealth Scientific and Industrial Research Organisation expects that the efficiency will increase to above ten percent in the next few years.

According to project leader, Gerry Wilson, the flexible solar cells would probably be available for commercial mass production within the next five years. He says the main advantage is that cells can be produced in vast sheets or rolls and used on roof tops or windows.

The existing printing presses could make about 100 kilometres of solar sheeting a day. The special printing presses, used to print Australian money, use a polypropylene film rather than paper to print bank notes and so it was fairly easy for engineers to adapt the presses to work with plastic suitable for making solar cells.

The polymer used in the solar cells is the product of a US\$7,7-million research project. The advantage of flexible cells is that they do

not need additional structural support because the film itself supplies support for the sheets, which can then be placed on any surface.



Peter Batchelor (left), Minister for Energy and Resources for Australia's Victoria state, and CSIRO's Future Manufacturing Flagship research leader Gerry Wilson examine a trial print-out of flexible organic solar cells.

Past Presidents’ Lunch

In February this year, the Past Presidents’ Annual Luncheon was held at the Woodmead Country Club. It is interesting to analyse the statistics of the Presidents. During this, the Centenary year of the SAIEE there have been 100 presidents and 29 of them are still alive and most of them still live in South Africa, with one exception, Dr David Jacobson, who now lives in Canada. During the lunch, Dr Anderson proposed the toast to the Past Presidents and the President, Victor Wilson, proposed the toast to “The Institute”.

The Presidents in the photograph are (from Left to Right) Bill Calder (1994), Mike Crouch (1993), Les James (1982), Viv Crone (2006), Dr Ralph Anderson (1979), Pierre Ballot (2003), Stan Bridgens (1998), John Gosling (2001), Bruce Jackson (1988), Ian McKechnie (2007)



Sy Gourrah is new AMEU President



Sy Gourrah, the general manager [Electrical and Mechanical] for the Buffalo City Municipality, was inaugurated as the President of the Association of Municipal Electricity Undertakings for the 2009 – 2010 term when the 2008 convention was held in East London.

The Association of Municipal Electricity Undertakings (Southern Africa) has a long and proud history and has been in existence for 94 years. Sy is the first lady president in its history.

The AMEU represents the electricity distribution undertakings of some 187 municipalities around South Africa. These organisations supply about 40 percent of the

electricity sold to almost 60 percent of the customers in South Africa. Municipalities are represented in the AMEU through their nominated Municipal Councillors and Electrical Engineers. A wide range of suppliers of goods and services to this industry are also represented in the AMEU as Affiliate members.

Through its publications, branch activities and annual conventions, the AMEU helps the industry to share knowledge on electricity matters, promote common causes and quality of supply excellence. It also has representatives serving on 29 different national committees, associations, boards and technical working groups involved in the electricity distribution industry.

Junior engineers are being trained on a smallholding

By Andre Hoffman

At the invitation of Brenda Windram from the Junior Engineers for Africa (JEFA) I visited their facilities in Northriding in March where Brenda and her sons Stuart and Lloyd Windram run courses and workshops for school learners from their small-holding in Northriding, north of Johannesburg.

The Junior Engineers for Africa (JEFA) was formed three years ago out of the success of the Lab Ratz (Lego) robotics team lead by Stuart as part of the Lego Educational and FIRST Lego League efforts.

Stuart (17) is the main driver and facilitator behind JEFA and he is energetically supported by his mother, Brenda and younger brother Lloyd. Stuart is still a school learner who will be writing his finals (A-Levels) in October this year and uses his spare time to either rebuild an old Land Rover Series III or, when he's not doing that, he's developing and running 'hands-on' workshops for enthusiastic young aspiring engineers.

There are about eight different courses being run, covering ages 5 through to 15. Using the whole range of Lego Educational materials, these courses cover:

- Foundations course (5-9) – covers the concepts of mechanical and structural stability along with conceptualisation and creativity along with communication and team-work.
- Junior technical (6-8) – basic maths, concentration, fine motor co-ordination, three dimensions, memory, logic and basic problem solving.
- Builder (7-9) – basic engineering principles, creativity, logic and problem solving.
- Junior Mechanic (8-10) – design, testing and operating large Duplo based machines
- Inventor (10-15) – creativity, conceptualisation, D-D design, concentration and memory development
- Pneumatics (11-15) – discovering how pneumatics works by building models and machines in a structured environment.
- Mechanical systems (10-15) – This course adds and reinforces the concepts already covered and builds on the principles of levers, axles, forces, hinges and gears and includes things like linkages, gear ratios, cranks and cams.
- Mechanical Engineer (11-15) – principles of physics, kinematics and kinetics, process management, concentration and problem solving and logic.

Stuart has also developed an additional specialised course on Robotics and Programming for some of the students (12-16) who have an aptitude for this. Here he uses the Lego RCX and NXT kit along with a supplement mechanical Lego set of parts.

Guided by Brenda and Stuart I was given an overview of the facilities which consist of some small outbuildings used mainly for administration and storage of the materials, but also for running some of the courses if the weather is not conducive to holding sessions in the marquee outside.

The large marquee is set up as the main classroom with a number of trestle tables and plastic chairs in the area. Facilitators, who are themselves senior school-level learners, all wear FEFA or Lab Ratz T-shirts oversee or supervise the groups as they work their way through the structured tasks and challenges during the session.

I spent the bulk of the afternoon with Stuart and the Robotics class, where I was very impressed by the dedication and enthusiasm of the students in achieving the objectives.

Stuart runs the class in a very unstructured way, but provides enough guidance and direction to afford the teams an opportunity to progress and yet still allow for individual creativity and expression.

In the two hours that I was there the four teams of learners built a 'Bob-Cat' type robotic vehicle from scratch. Stuarts only instruction to them was to build the vehicle, which he explained with words and hand movements only (no drawing), and then left them to interpret and implement this challenge in accordance with their own understanding and prior learning abilities.

As students ran into barriers or difficulties during the afternoon, Stuart would provide the necessary questions and guidance to allow them to learn and progress. By 15h30 teams were testing and modifying their vehicles on the test table and were visibly excited at their achievements. The uniquely different machines performed in accordance with their programmed instructions.

By 16h00 the learners have completed their tasks and head home after packing away everything they've used in readiness for next week's session.

Brenda explained that ten sessions are run during a school term, usually on a Friday. Each learner pays R40 per session or R400 per term. These funds are used to cover the costs of running the programme, which include paying the facilitators a small stipend and buying the expensive Lego materials which all have to be imported from Denmark.

Stuart and the JEFA team also participate in Science fair's run in Stellenbosch, Grahamstown and Pietermaritzburg.

JEFA don't advertise at this point as facilities are very limited although they do have some capacity to take on more students should anyone be interested. Their main source of students come from the 'home-schooling' network where learners can use this opportunity to supplement their home based schooling with a more sociable and interactive learning opportunity.

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Learners come mainly from the surrounding area, although some come from as far away as Centurion to participate in the sessions.

There is only the one facility at present, but the potential exists to expand this programme into schools or other communities should suitable sponsors and facilitators be found.

The greatest need at this point seems to be:

- Better facilities to run the courses,
- Funds for material and to pay for disadvantaged student so that they, too, can attend the classes.

My understanding of the vision that Stuart and Brenda have is to formalise JEFA into a Section 21 company and expand its reach, in a controlled and manageable way, into more schools in the area. Perhaps, with the right level of sponsorship and interest, the JEFA

programme could become a national project, controlled from Johannesburg.

Clearly, Stuart has a great deal of passion for science and technology and also has an unusual capacity, for someone his age, to impart knowledge to others around him in a way that is neither patronising or domineering.

My own opinion is that Stuart is one of those rare people with energy and potential for facilitating engineering skills very effectively in the future.

I really believe that JEFA is a worthy organisation worth sponsoring and I would encourage any private sector companies that are looking for a worthwhile cause to consider working with JEFA and Stuart to extend the programme.

Meet du Toit Grobler

– SAIEE’s new President

du Toit Grobler was born in Grootfontein, Namibia in October 1948 and matriculated at the Vereeniging High School in 1966, where he was the head prefect of the school. During 1967 he did his compulsory military service at the SA Air Force Gymnasium, Valhalla.

du Toit received a bursary from Iscor to study electrical engineering and graduated from the University of Pretoria in 1971 with a B.Sc. Degree in Electrical Engineering. In later years he was granted Government Certificates of Competency as an Electrical and Mechanical Engineer for Factories, Mines and Works. He has completed the Unisa School of Business Leadership Management Development Programme (MDP-AAC).

From 1972 to 1981 he worked for Iscor at Newcastle, Vanderbijlpark and Durnacol operations. During this time he held various positions, ranging from Assistant Project Engineer (Electrical) to Assistant Resident Engineer (Projects and Planning).

During 1973 du Toit was seconded to SA General Electric and spent nine months with General Electric at various locations in America as part of the company’s graduate engineers’ training programme.

On his return to South Africa he remained on secondment with General Electrical for 17 months during which he was a member of the GE Drive Systems commissioning teams at Iscor, Vanderbijlpark and Newcastle.

In 1981 du Toit joined the mining industry where he held various positions as Resident Engineer and Engineering Manager with Anglo American and Gencor.

In 1991 he joined the Technical Division at Sappi SA and is the division’s Senior Regional Electrical Engineer. The Technical Division

provides consulting and project services to nine saw, pulp and paper mills in southern African.

du Toit is registered with the Engineering Council of South Africa as a Professional Engineer and as Professional Certificated Engineer. He is also registered on the International Register of Professional Engineers

in accordance with the Washington Accord, as an International Professional Engineer (Electrical and Electronic). He is a Member of Council of the Engineering Council of South Africa 1995 – 2009 and serves on a number of Council committees.

du Toit joined the SAIEE in 1969 as a Student Member and he is now a Fellow of the Institute. He has been a member of the Power Section since 1997 and has served on the National Council of the Institute since 2003.

He received the SAIEE 2005 Engineer of the Year Award, sponsored by Alstom SA. He is a Senior Member of the Institution of Certificated Mechanical and Electrical Engineers, SA, a Council Member and a Past President (1995).

du Toit is married to Elize and they are the proud parents of a daughter, two married sons and a grand-daughter.

