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The Energy Efficiency issue

SAIEE THE OFFICIAL MOUTHPIECE OF THE SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS | **JANUARY 2012**

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It is 2012 and the sounds of Christmas paper tearing, jingle bells over the radio, giving gifts and drinking bubbly are all a distant memory. Most of us hit this year running!

I wish all our **wattnow** readers and SAIEE members a prosperous new year.

This issue, being our Energy Efficiency issue, is filled from cover to cover with very interesting news, things and people. On page 16 we showcase the winners of the SAIEE National Student's Competition - the 2011 competition was of such a high standard that the judges were gobsmacked with the innovation and creativity that went into these concepts.

On page 20, Col. Riaan Botha, Project Manager of the South African Police Services (SAPS) shares with us how they received the 'green' light on energy efficiency and protecting the environment at certain police stations.

On page 52 we show you what can happen when you step on a mercury lightbulb. It is very graphic and my aim is for readers to share with their loved ones the dangers of something that seems so trivial.

Page 63 sports our January crossword, sponsored by Clear Fuel Technologies - please take a chance, send your entries to me to stand a chance to win the R1000 prize money.

Page 67 features our subscription page, if you would like to receive your copy of the **wattnow** magazine, but you are not a SAIEE member, fill in the form and send it to me.

Unfortunately, due to his heavy commitment, Mr. Moloko was unable to complete part 2 of the Surge Arrestor article. I trust that his article will be included in the February issue.

I have received wonderful feedback from our readers and members. I intend publishing some of those letters in our next issue. My sincere thanks to all of you.

Herewith the Energy Efficiency issue, enjoy the read!

Earn CPD Credits

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



SAIEE CONFERENCE AND EXHIBITION

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The SAIEE has a membership of almost 6000 Electrical Engineers, in South Africa and abroad, who are active in all spheres and aspects of electrical and electronic engineering. These professionals are associated with tertiary learning institutions and the Engineering Council of South Africa (ECSA). The SAIEE is therefore ideally placed to provide a high level platform to disemminate topical and essential information on energy provision, and implement it sustainably in our modern world.

PAPERS

We call on experts, suppliers and users of electrical energy to submit papers, which will be considered for presentation at this important and topical conference. The SAIEE Conference is the best platform to convey the use of electrical energy efficiently. In a changing world, our aim is that this energy is provided safely in an environmentally friendly way.

Our future on this planet demands that it be nurtured, and that the energy supplies be sustainable for generations to come.

Please submit papers, with a profile of the presenter, for consideration to the Chairman of the Review Committee, by no later than 31 March 2012.

Papers accepted will earn presenters Continuing Professional Development (CPD) Credits. All paper should be emailed to geyerg@saiee.org.za.

The Review Committee will advise authors on the acceptance of their papers by no later than 31 May 2012. Provision will also be made for poster papers to be exhibited at the conference venue. The decision of the Review Committee is final.

EXHIBITORS

We invite manufacturers, engineers, architects and technologists to exhibit their concepts, ideas and products for renewable energy generation. Enlighten us on the efficient use of electrical energy in modern buildings and manufacturing facilities.

ATTENDEES

SAIEE Members automatically qualify for a special discount of 20%. Please email Gerda Geyer on geyerg@saiee.org.za.

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Dear valued member and advertiser,

It gives me great pleasure to welcome you all in the new year and hope that you had a good and safe rest over the past festive season. The end of 2011 saw the successful launch of the new look **watt**now magazine under the editorship of our Managing Editor, Minx Avrabos. I am sure that you enjoyed the November 2011 bumper edition as much as I did.

The past year, 2011, was characterized by a high level of activity for the SAIEE. The President Invitation lecture, delivered by Dr Azar Jammine of Econometrix was well attended. He updated us on world macro-economics and how the domestic economy is influenced by what happens globally. We are part of the global village. The 60th Bernard Price Memorial Lecture, delivered by Philippe Paelinck of Alstom France was well attended at the centres as well as at Wits. The lecture was entitled: Carbon Capture and Storage, Ready to deliver. We thank Philippe and Alstom France for a most informative lecture on the subject. Indeed, the lecture was most appropriate and relevant in view of the fact that in November/December 2011, South Africa hosted COP17 in Durban.

The Annual SAIEE Annual Banquet was successfully staged at the famous Wanderers Club at Illovo, with record attendance. The guest speaker was Mr Hanief Ebrahim from the National Planning Commission (NPC). His speech covered the NPC diagnostic report published in June 2011. We also saw the official opening of SAIEE House in October 2011. The occasion was graced by the Minister of Science and Technology, Mrs Naledi Pandor.

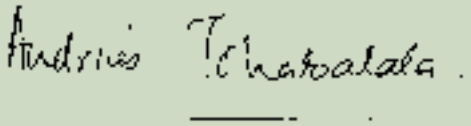
Council requested Past President, Mr Michael Crouch, to seek sponsorship from our industry partners for contributions towards the new building. Donor company names and logos will be featured on a roll of honour in the building in recognition of their support. I am most humbled by the generous response shown so far. Please note that companies can still contact Mr Michael Crouch in order to pledge their donations. I thank Mr Michael Crouch very much for agreeing to do this work.

In November 2011, I managed to attend the SAIEE National Student Competition held at the North West University, Potchefstroom Campus. This competition is co-sponsored by EE Publishers and the SAIEE. We thank EE Publishers for their ongoing insightful support and hope to continue the relationship going forward with this competition. I also wish to thank the judges for a job well done, Stan and Gerda for a well organised competition. I was totally blown away by the student talent showcased by 7 universities and 4 universities of technology and warmly congratulate the winners. The standard of the projects was very high! In my view, all the entrants are winners.

The theme for my presidential tenure is: Engineering the future: The relevance of the SAIEE in our contemporary times. So far, I am sure that you will agree with me that we do indeed continue to be relevant.

May I wish you and your loved ones a blessed and successful 2012.

Enjoy reading this edition of **watt**now.



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WATTSHOT

COOLEST GREEN GADGETS FOR 2012

2012 is here and we need to be prepared to do our part in energy efficiency. Here are some of the coolest green gadgets available in South Africa.

LED DOWN-LIGHTS ARE SHINING THE WAY FORWARD

South African energy-saving and back-up power solution specialist, Mr. Power, has recently added new LED down-lights to his product offering. 50 watt down-lights have a bad reputation for burning out quickly, chewing electricity and getting stuck in the fitting – all of this is because they draw a lot of energy, most of which is lost in heat. In some extreme cases, they can even become a fire hazard. Mr Power's LED down-lights are the solution to all these problems. They are of such a high quality their lifespan is anywhere between 15 000 and 25 000 hours! Assuming they are on for an average of four hours a day, the LED down-lights will last well over 20 years AND, Mr Power guarantees them for two years from purchase. Energy saving is a personal and national priority for all of us. The rise of the "green economy" has ensured that countries around the world are investing in solutions that reduce unsustainable energy consumption and increase energy efficiency. "See the light" with Mr Power's LED down-lights, for only R189 each – for more information and to find your closest distributor, please visit www.mrpower.co.za or call the Mr. Power team directly on 011 804 2988.

ECO-INSULATION

Eco-Insultation is a cellulose fibre ceiling insulation product made in South Africa from recycled paper. Eco-Insulation can provide significant electricity savings and carries a lifetime guarantee. According to the manufacturer, the product is fire resistant; unattractive to rodents and insects; has proved its long-term resistance to both wet and dry rot; is non-toxic, non-irritant & non-allergenic; uses no asbestos or glass fibre. The only drawback is that if you have a serious roof leak, the 'paper' can get too heavy and it can damage to your ceiling - so you need to make sure your roof is leak-proof. According to the manufacturers, the recovery period from the cost of Eco-Insulation is plus minus 3 years in energy consumption. www.eco-insulation.co.za

INNOVATION: NEST LABS UNVEILS THERMOSTAT THAT LEARNS

Nest Labs, founded by former Apple execs who helped develop the iPod and iPhone, announced today the launch of a thermostat that "learns," making it simpler than ever to program schedules and, even better, save energy. According to the company, the Nest Learning Thermostat uses sensors, algorithms, machine learning, and cloud computing and adjusts temperatures up and down for comfort when the home is occupied and energy savings when it's not. As homeowners adjust the temperature, the thermostat programs itself, learning schedules within a week and automatically turning down heating or cooling when they are away. You can tell Nest is different with just one glance. The high-tech-yet-approachable design—with color-changing screen, rotating temperature-adjustment ring, and push-button menu—appear very much in line with the user-friendly interfaces that have made iPod products successful. A blue display indicates cooling, red indicates heating; a green leaf appears when the user selects efficient settings. In addition to guiding homeowners toward efficient options, Nest has Auto-Away sensors that can detect when no one's home and change the temperature setting accordingly. Homeowners also can access and adjust the thermostat from a laptop, smartphone, or tablet.

OXYGENICS

Oxygenics showerheads say they are able to "blow you away"! Jet-powered through an accelerator fin, infused with oxygen from the surrounding air, and using non-stick Delrin for a maintenance-free product, Oxygenics claims to give a "healthy, powerful, and oxygenated spray". The accelerator fin is, in fact, three fins which spin as water enters the shower-head, propelling the water forward with greater velocity. The water is sent through a channel before leaving the shower-head, where it absorbs oxygen filtered in from the surrounding air. This process is said to give a better shower experience, and save water by propelling a slightly lower quantity of water than normal showers, but at a higher velocity, and infused with oxygen. The oxygen-infused water is also said to be benificial to your health, as it can be absorbed by the skin. Based in Cape Town. www.urban-solar.co.za

GARDEN RESQ GREY WATER SYSTEMS

Grey water recycling is not a new phenomenon and has been in use in the United States and Australia for many years. By re-using grey water in a responsible manner, the demand for potable water can be dramatically reduced.

GardenResQ provides a system that can save your garden by using already used household water - providing water savings that are beneficial to both local government and the private home-owner. The Garden ResQ unit is fabricated from robust material that has been designed to withstand the harsh South African climate. If insalled and maintained correctly, GardenResQ promises that the system will provide you with many years of trouble free service. The costs for a system is R3,395 (vat included) plus R90 delivery to any location in South Africa. www.gardenresq.co.za

eWASA

Electronic waste, known as e-waste, includes old computers, LCD screens, cooling appliances, cell phones, CDs, etc. These products contain precious metals, BRF plastics, and other non-degradable and potentially dangerous substances. Most of the time, our old electronic appliances end up in the landfill because there is nobody that we know of to recycle them, or it is too much of a mission to get it done. The e-Waste Association of South Africa (eWASA) offers the solution to this ever-growing problem. They have collection points in many places all around South Africa. To find your nearest collection point, use this link: www.ewasa.org/ewaste/collectionpoints

SUNSTOVE

The Sunstove is a light solar energy stove for small families that cooks and bakes and can reach 115ºC. The Sunstove will cook for a family of 4 - 6 people and takes approximately 60 minutes to boil one litre of water. www.sungravity.com

WATTSHOT

GADGETS FOR 2012

Samsung Galaxy 7.7 Tablet

With only 7.89 millimeters thick and weighing 335 grams, the Galaxy 7.7 presents users with a Super AMOLED display that offers high contrast and accurate viewing experience, allowing a wider variety of colors, with better separation between light and shade tones. The battery will last up to 10 hours.

LG Smartscan mouse

The new mouse from LG has a built scanner. All you need to do is press the Smart Scan button located on the left side of the mouse device and roll over the material they want to scan. The scanned image can then be saved in the desired format (PNG, JPEG, TIFF, BMP, PDF, XLS or DOC) or placed in a document or an application with drag & drop. The technology involves a proprietary optical character recognition to convert scanned text to a Microsoft Word document that can be edited if desired. This 2-in-1 device can scan A3 pages.

Sony 3D viewer

One of the most futuristic devices presented at the IFA is "Personal 3D Viewer" from Sony. It is mounted on the head and gives the user a new style of 3D viewing experience. Sony 3D viewer consists of two different displays, one for the left eye and one for the user's right eye. To provide an experience full surround-sound device incorporates headphones.

VIERA Neo Plasma Panasonic: 2D to 3D conversion

The new Panasonic Viera range Neoplasms technology provides an excellent conversion from 2D to 3D image. The new Line is distinguished, equipped with technology Infinite Black Panel Pro, THX certification for their 2D to 3D playback and can connect to certain Internet content via VIERA Connect. Moreover, they are Wi-Fi ready (via USB) and DLNA certification, offers the possibility of making video calls via Skype, and can playback pictures and videos thanks to VIERA Image Viewer.

SURGE ARRESTERS FOR DC PHOTOVOLTAIC APPLICATIONS

The rapidly growing PV industry, now generating at DC voltages of 600 and 1 000 V, has placed exceptional demands on the present and previously available SPD products intended to protect systems components such as inverters, arrays, or combiner box components from the effects of lightning caused surges and transients.

Responding to this demand DEHN has developed and introduced a new product, specifically designed to function under the issues associated with these DC voltages. The new DEHNguard M YPV and PV-SCI addresses those issues by incorporating a switched fused circuit in parallel to the MOV discharge circuit, permitting the disconnect to operate arc free.

DEHN has recently expanded their initial product offering to now include a broader range of voltages and product configuration. These unique SPD products are now available for 150V, 600V, 1 000V, 1 200V and 1 500V DC applications and are configured in both a 'Y' (three-pole) configuration for floating systems, and a two-pole design for grounded systems. DEHN is represented locally by Surgetek.

MODULAR LIGHTNING CURRENT SURGE ARRESTERS

DEHN's Red/Line DEHNventil lightning current surge arresters are designed for 'all-in-one installation' making them ideal for use in compact electrical installations. With their lightning current discharge capacity up to 100 kA (10/350 µs) the modular SPDs ensure a high degree of protection, and even in large-scale electrical installations, the DEHNventil devices offer various application options.

Red/Line surge arresters installed at the boundaries of the individual lightning protection zones are already energy-coordinated with DEHNventil devices. Encapsulated creepage discharge spark gaps and the small space required by DEHNventil arresters allow easy integration into switchgear installations or distribution boards. A special feature of the DEHNventil family is its functional design. The module release button is a key element. It fixes the protection module firmly in place so that it is safely connected to the base part even at maximum loads. Protection modules can be easily replaced without tools by pressing the module release button and removing the protection module.

The devices incorporate double terminals, allowing series connection in a space- and cost-effective manner according to IEC 60364-5-53 requirements for nominal currents up to 125A. For connecting further DIN rail mounted devices, type MVS 3 8 6 and MVS 4 11 8 busbars can be used.

Operating state/fault indication of each protective circuit immediately provides information on the operating state of the surge arrester even if no power is present.

Apart from the standard green and red indicator, DEHNventil M ... FM devices feature a three-pole remote signalling terminal. With their floating changeover contact, the remote signal can be used as a break or make contact according to the particular circuit concept.

Various models are available for TN-C, TN-S, TT and TN-S, TN, TT and TN systems. DEHN is represented locally by Surgetek.

For more information, contact Surgetek
on Tel: (011) 792-1303/4/5
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www.surgetek.co.za

WATTSUP

The Greenest Municipality Awards 2011

The Mayor Clr Nel(3rd from the left) the team of municipal officials involved with the project and contractor staff at the official opening on the 15th of November 2011

Recently the Department of Environmental Affairs & Development Planning invited all Western Cape municipalities to participate in the Greenest Municipality Competition (GMC).The Hessequa Municipality was one of the municipalities which had taken part. This initiative is seen as an opportunity to promote service delivery, restore community pride and demonstrate a commitment towards caring for the living environment.

In October 2011, the Hessequa Municipality was awarded the trophy for being the best achievers for Energy Efficiency and Conservation. Ms Lorna Scott, Project Manager: Sustainable Development, was also awarded a GMC medal for 2011, for being the green champion for the Hessequa Municipality. The performance areas in which the municipality excelled in include the initiation of renewable energy projects to be established in Hessequa and our demand side management.

Hessequa commenced with these initiatives in 2007 and included the installation of load control meters in all homes and was the first municipality in South Africa to install solar water geysers for low cost housing. The Hessequa municipality exceeded the Eskom target of a 10 % energy saving by achieving a 23.2% saving and continues to reduce consumption. Recognition must be given to the dedication of Mr Mans who continues to take care of the Riversdale diesel generator which is still in operation after 50 years. The fact that we still operate this unit means that we have a competitive advantage in bidding for renewable energy projects as we are already in possession of a power producer's licence.
Mr Mans also supervised the roll out of energy efficient light bulbs to the community.

POWER-GEN Africa announce Call for Papers Now Open

6-8 November 2012
Sandton Convention Centre,
Johannesburg, South Africa

POWER-GEN AFRICA are now inviting industry experts from around the world to share their knowledge and experience at this important industry gathering by submitting an abstract of a paper they wish to deliver.

Abstracts of between 100-300 words are now being accepted. To submit your abstract for consideration by the POWER-GEN Africa Advisory Board please click on www.powergenafrica.com.

The POWER-GEN Africa Advisory Board has released the conference topics and announced that the 2012 conference will consist of three tracks running simultaneously. Under the conference theme of Global Technology for Local Solutions, POWER-GEN Africa 2012 will feature leading power industry professionals from around the world who will share their expertise and experiences to help define Africa's energy sector of the future. The three-track conference will work under the broad headings of Strategy, Technology and Renewable Energy, each with sub-topics to ensure broad coverage of the industry within Sub-Saharan Africa. Detailed track information can be found at www.powergenafrica.com.

"This exciting new industry forum is set to become the region's premier conference dedicated to the power industry. It will also provide the perfect setting for industry leaders and decision-makers to network and keep abreast of the latest developments in the Sub-Saharan region in the field of power and energy. POWER-GEN Africa will provide comprehensive coverage of the technology options, power needs, resources, and issues facing the electricity generation industries across Sub-Saharan Africa" said Nigel Blackaby, POWER-GEN Africa Event Director & Conference Director for PennWell's International Power Group.

POWER-GEN Africa hope to receive high-quality submissions covering all topics, which upon receipt will be discussed by the POWER-GEN Africa Advisory Board for potential inclusion in this new and exciting industry event.

Registration for POWER-GEN Africa will soon open, allowing interested parties to register to attend this exciting three day event, as either a conference delegate or exhibition visitor. Please visit www.powergenafrica.com for further information on registration and to take advantage of the Early Bird Discount rate.

PneuDrive Challenge – Stellenbosch Score a Close Win Over TUT and WITS

L-R: Prof Anton Basson; Norval Geldenhuys; Hardus Scheepers; Cornel Liebenberg; Daniël Malan

After two intensive days of judging the panel of judges concluded and agreed that Stellenbosch University's Sunnyside Packer was the winning entry. The Air Bot design from the Tshwane University of Technology was a very close second and the Automated Restaurant from WITS placed third. The Blitz Burger from the University of Johannesburg was commended for their innovative ideas.

STELLENBOSCH UNIVERSITY: SunnySide Apple Packer ~ Students Norval Geldenhuys, Cornel Liebenberg, Daniel Malan and Hardus Scheepers delivered a design report that is essentially a "high-speed, accurate and selective apple packer". They noted that because apple packing is currently done by hand, many potential problems with labour – including inconsistent quality – are experienced by farms and distributors.

Their proposed packing machine is designed to improve the marketability of first-grade boxed apples. This is accomplished by boxing "red" apples (any apples with some red colouring) with their best-looking and best-coloured side facing upwards.

Packing apples in this manner produces a much more desirable box than a randomly packed box, an obvious benefit to retailers.

Airbot model

TSHWANE UNIVERSITY OF TECHNOLOGY – TUT Air Bot

The TUT submission by Izak Nel, Alfred Barnard, Coenraad Prinsloo and Christiaan Oosthuizen investigated the distribution of food and beverages on air flights, with a local airline company serving over 1.4 million meals a year. With only rudimentary and manual services in place, the airline service industry in general faces massive risk due to the losses of stock, revenue and time.

Recognising that there is no existing solution in the "air industry" at this stage is interesting. Their solution of a mechanical process to electronically monitor and distribute stock is "out of the box" thinking that will surely attract interesting comment.

UNIVERSITY OF THE WITWATERSRAND – Automated Restaurant

Students from the WITS School of Mechanical, Industrial and Aeronautical Engineering, Mduduzi Masuku, Lefa Madire, Meshi Hamese and David Ndeveelo, presented a design that shows how an automated restaurant could replace waitrons.

Their design makes use of a mechatronic system that automatically transfers food trays from the kitchen to the customer's table.

L-R: Mduduzi Prince Masuku; Lefa Matape Madire; Meshi Lucas Hamese; David Ndeveelo

The design is composed of sub-systems that need to raise and convey loads from the chef to their designated locations in a restaurant. The design is space efficient in the sense that most of the mechanical components are isolated from the dining floor, unlike the Sushi and Michael Mack's fully automated restaurants and presents some interesting alternatives to delivering food in a restaurant.

UNIVERSITY OF JOHANNESBURG – Blitz Burger

The UJ team of Jason Berry, Warrick Kin, Izak Coetzee and David De Ponte came to the consensus that a "food and beverage presentation showpiece" designed to demonstrate technical precision, efficient and fast delivery in a fun and engaging manner would bring home the message of Festo and SEW Eu-rodrive as leaders in their field. Their "Blitz Burger" is not only a good idea as a showpiece, but is also applicable in the "real fast food world".

THE JUDGING TEAM

This year's judging panel were made up of Tobias Nittel (Technology Field Manager Food and Beverage for SEW Eurodrive), Stefan Molenaar (Managing Director of HG Molenaar), Chris Oliver (Sales and Development Engineer at FESTO Didactic), Jacques Du Sautoy (Automation Specialist at Nestle) and Andreas Keller (Sales Manager at FESTO Europe West - North). The winners receive a ten day all expenses paid trip to Germany for their group and the runners up receive a Canon digital camera each. Furthermore the winning university receives R 100 000 worth of products from SEW Euro-drive and Festo while each participant is entitled to R 40 000 worth of products for completing the competition.

WATTSUP

Hartebeeshoek Site Visit

During September a site visit to the Telkom satellite earth station was undertaken. As can be seen from the photo, the site is nestled between the mountains where the electrical "noise" is low. In 1975 low power satellites were used that required the building of 32m diameter antennas. The antennas used the 6 GHz band to send data (uplink) and 4GHz receive data (downlink). This is called C-band communication which is used for international communication. The Ku band (Tx 14 GHz Rx 11GHz) was introduced later and is mainly used for local domestic communication.

The earth turns at approximately 1600 km/hour at the equator and at approximately 1580 km/h at the Hartebeeshoek site. To make this even more complicated, the earth is speeding at approximately 107 000 km per hour around the sun, and the earth is rotating on its own axis once in 24 hours. To keep the satellites at a virtual stand-still with respect to the earth (called Geo-stationary), they are placed at 35 785 km above the equator. This Geo-stationary satellite "moves" at 11 000 km per hour to circle the earth once in 24 hours. At this speed and altitude the force of gravity and the centrifugal force are equal and the satellite remains "on station". So why does the satellite not burn up at that speed? There is no air (of course) to cause friction.

Visitors were told that it is best to "see" the satellite at between 10 and 35 degrees for best noise suppression. There is a slight movement of position between the earth and the satellite (called the figure of 8 drifting of 48 km from the centre of the '8'). For the satellite not to move too far away from its position, hydrazine gas jets are used to move it "back" to its position. The lifespan of these jets is limited to about 15 years, after which the gas is used up and the satellite crashes into the earth's atmosphere and burns up.

To accurately track the satellite you need to carefully follow this movement in the narrow range of between 0,1 and 0,4 degrees. The 32m diameter antenna, weighing 360 tons, thus needs to move all the time using a 27 000:1 gearbox! Wow!

To keep a satellite working in space is tricky due to the absence of 220v power. Solar power is used with re-chargeable batteries and applying this you can only send a constant 150mW signal. The loss to the earth is 200db. To counteract this loss, the 32m antenna is designed to have a net gain of 64. What is interesting is that only a millionth of a millionth of a watt is received by the receiving antenna.

There are a few factors that impair the working of satellite technology. Worth mentioning is that a good old rainstorm attenuates the signal as the microwave signal is absorbed by water drops. The round-trip delay using a satellite link is 500 msec per hop between the earth and the satellite. So just finishing a word and getting a response from your friend means a one-second delay. It does not sound like a lot but can be disturbing when you are having a conversation. Solar flairs and low flying aircraft also cause irritation to the technical crews. Well, after all of this, there must surely be some advantages for all the trouble these guys go to!

Satellite technology is good for point to multipoint communications. Ease of site establishment means that a total earth segment station can be deployed within hours. The downlink is shaped to cover the required area on earth; for example the whole of South Africa. This area is known as the "Footprint" of the satellite. Companies can have mini teleports on their buildings to service all their outlets countrywide. Ground equipment is relatively reliable and easy to maintain and a satellite system is a good gap-filler where terrestrial links cannot be established.

The following pictures show the parabaloid "dishes" at the site, and the visiting group standing on the back of a dish gives some idea of its size. wn

Bursaries to students with energy efficiency vision for SA

Brian Saunders and Sheree Anne Marinus, two 2nd year Bachelor of Architecture students at the Nelson Mandela Metropolitan University (NMMU), were announced as two of the three deserving recipients of bursaries from the Southern African Association for Energy Efficiency (SAEE), a chapter of the US-based Association of Energy Engineers (AEE). Merishka Singh, also in her 2nd year of study toward a Degree in Town and Regional Planning with the Durban University of Technology (DUT), is the third recipient.

All three candidates delivered excellent academic results in their first year of study which demonstrates good work ethic, dedication and determination. The SAEE bursary committee is overwhelmed by the enthusiasm shown toward the energy efficiency cause by these youngsters. The three awardees have been earmarked as persons with great vision for the future of South Africa.

Marishka Singh from DUT received her SAEE Bursary from Edith Kikonyogo, Board Member of the SAEE.

Sheree Ann Marinus from NMMU.

Brian Saunders from NMMU.

Double-whammy award for Energywise

The SAEE Energy Company of the Year Award was presented to KwaZulu-Natal company, Energywise Systems Magnet Electrical Supplies, at the Southern African Association for Energy Efficiency's (SAEE) Awards Ceremony. The Awards Ceremony formed part of the official annual SAEE Banquet which marked the opening of the 6th Southern African Energy Efficiency Convention (SAEEC2011) and Exhibition on the 16th of November 2011, held at Emperors Palace, Gauteng. Not only did Energywise shine as Energy Company of the Year, but was also awarded the Best Single Exhibition Stand of the SAEEC2011, for its interactive hands-on display of water and energy saving devices.

SAIEE Plaque unveiled at the Riversdale Power Station

Members of the SAIEE were treated to a tour of the station, during which three of the large diesel generators were started up, and given a short history of the facility, as well as plans for operating on biofuel in the future.

Southern Cape chairman Willem du Toit described the activities of the Historical Section, while Les Stuart paid tribute to the Riversdale staff who were responsible for the maintenance and operation of the station, under the management of Gert Mans, who has served on this site for over 40 years!

The plaque was unveiled by the Executive Mayor Mrs. Emor Nel, who thanked the Institute for the recognition and honour conferred by the plaque.

2011 SAIEE National Student Competition

BY | STAN BRIDGENS **|** SAIEE BUSINESS DIRECTOR

Over the past 23 years the SAIEE has organised an event for final year students studying electrical and electronic engineering. This is to present their projects to an audience, and a panel of judges, in competing against each other for prizes or awards in excess of R25,000.

This competition was previously intended only for universities, but it is now open to all tertiary learning institutions that provide courses for both the Bachelor of Science Degree in Electrical Engineering, and the Bachelor of Technology Degree in Electrical Engineering.

The aim of the competition is to provide a platform, not only to display the talents of the graduates of these tertiary institutes, but also to display the quality and standard of projects that are the products of South Africa's universities and engineering training institutions. This is all part of the SAIEE's involvement and commitment to provide mentorship and professional development support to young electrical engineers.

The competition venue rotate among the universities and universities of technology in SA, and usually occurs towards the end of November of each year. All the logistics are managed by the secretarial staff of the SAIEE and the respective tertiary institute hosting the venue for the event.

Timing of the event depends on the year-end programme of the tertiary institutions involved. The logistical challenges are not trivial, nor are the travel and accommodation arrangements which are required for the competitors gathering at one venue from all over South Africa.

There are usually 8 presentations each for the BSc and BTech courses, which make for a full day of intensive competition. Each presentation is limited to 15 minutes, including question/answer sessions. This also creates an opportunity for the wider engineering fraternity, and parents, to experience the application of up-to-date technology in electrical engineering as taught by institutions.

CURRENT STATUS OF EVENT

Over the last 5 years the event has enjoyed the best of venues and the numbers in the audience have been increasing at major centres.

It is a known fact that all modern progress depends on the application of new technology. In electrical engineering the pace of this advancement is staggering, to the extent that it is generally not possible for engineers to keep up with developments, let alone the general public.

For this reason it is a statutory requirement that registered electrical engineers prove their continuing professional development when renewing their registration with the Engineering Council of SA. This applies to all registered professional engineers, technologists, certificated engineers and technicians.

THE WAY FORWARD

It is planned to expand the event, and in parallel, provide an exhibition wider than just the projects and presenters in the competition. This will display as many projects of the host as well as any other projects of nearby institutions. Tertiary institutions, such as the SAIEE have difficulty in choosing a project for competition. This indicates that there are many more projects which could be on display, and which would be of interest to the many visitors attending the event. Entrepreneurs could find young eager engineering enthusiast with whom they could engage, or employ, to nurture within their businesses. In effect the competition provides a platform similar to the Cannes film festival, but in this case a festival of projects, ideas and engineering talent on display for the engineering and entrepreneurial community to witness and engage. It also provides a place where experienced practicing engineers can obtain credits for maintaining their professional registration and keep up with developing technology. Practicing professionals are encouraged to attend these exhibitions.

The event provides for eligible sponsors to sponsor the monetary prizes, bursaries, visits, specialised training, accommodation and travel, as well as projects of interest to be further developed or completed for patenting or commercialising.

Over many years the SAIEE has provided funds of many millions of Rand for bursaries and events such as the NSPC that develop engineers. Long may it continue to do so.

For more information on the National Students Competition, contact Gerda Geyer.
T 011 487 3003
***Email** geyerg@saiee.org.za.*

The winners are...

It was that time of the year again, when November sees the SAIEE National Student Project Competition taking place, and this year, the competition was hosted by the prestigious North-West University (Potchefstroom Campus).

ANDRIES TSHABALALA WITH JAPIE GREEFF
TSHWANE UNIVERSITY OF TECHNOLOGY

ANDRIES TSHABALALA WITH THEMBANI MZEKELI
CAPE PENINSULA UNIVERITY

ANDRIES TSHABALALA WITH MYRIN NAIDOO
UNIVERSITY OF PRETORIA

BENJAMIN SIM (L) & BRADLEY MARCQUES (R)
from WITS University with Andries Tshabalala

Professor Johan Rens welcomed all the participants and guests and explained the procedures for the day. Mr. Stan Bridgens, Business Director of the SAIEE, introduced the judges, Viv Crone, du Toit Grobler, Wayne Fisher, Jane Buisson-Street and Patrick O'Halloran to the audience and explained the ground rules of the competition including the timing procedure for the presentations.

The following projects were presented to the audience:

- University of Johannesburg (B Sc)
  "Inductive Energy Scavenging Wireless Sensor System" by Thean Hoogenboezem
- University of Stellenbosch (B Sc)
  "Automated Vehicle-Based Image Capture System" by Darren Croucher
- University of the Witwatersrand (B Sc)
  "Mona Lisa's Smile" by Bradley Marques & Benjamin Sim
- North-West University (B Sc)
  "Motorised Panoramic Head" by Martin Terblanche
- University of KwaZulu-Natal (B Sc)
  "An Electric Trailer" by Andries Becker
- University of Cape Town (B Sc)
  "Autonomous Terrain Robust Robot" by Nishant Mistry
- University of Pretoria (B Sc)
  "Smartphone Controlled Unmanned Vehicle" by Myrin Naidoo
- Nelson Mandela Metropolitan University (B Tech)
  "Design and Implement and Alternative Energy Power Supply as a low cost solution to RDP housing Power requirements by Cornelius de Lange
- Tshwane University of Technology (B Tech)
  "Util Labs Generic Test Jig Framework" by Japie Greeff
- Cape Peninsula University of Technology (B Tech)
  "Radial Feeder Protection Training Module" by Thembani Mzekeli
- Vaal University of Technology
  "Reptile Incubator/Enclosure Temperature Monitor" by Neil Jansen van Rensburg

The President congratulated the following recipients and handed a floating trophy to each first prize winners:-

UNIVERSITIES OF TECHNOLOGY CATEGORY

The first prize winner of R3,000 were awarded to Japie Greeff from Tshwane University of Technology (B Tech) for presentation "Util Labs Generic Test Jig Framework".

The Judges Discretionary Prize of R1,000 for addressing an acute current engineering training need in the protection arena were awarded to Thembani Mzekeli of the Cape Peninsula University of Technology (B Tech) for his "Radial Feeder Protection Training Module" presentation.

UNIVERSITIES CATEGORY

The first prize of R3,000 were awarded to Myrin Naidoo of the University of Pretoria (BSc Eng) for his "Smartphone Controlled Unmanned Vehicle" presentation.

The Judges Discretionary Prize of R1,000 for an advanced technology technique for data encryption went to Bradley Marques & Benjamin Sim of the University of the Witwatersrand (BSc Eng) for his "Mona Lisa's Smile" presentation.

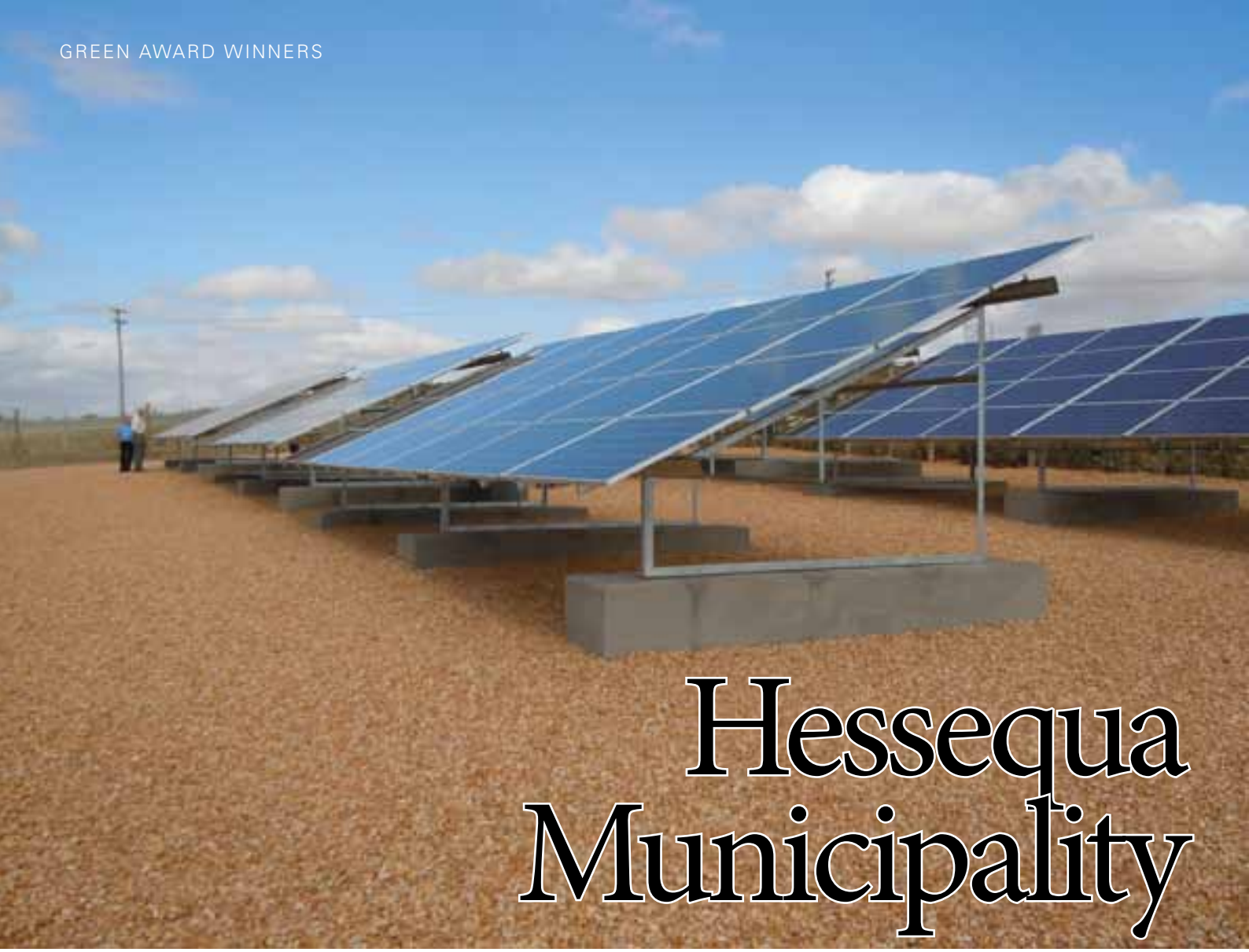
The event was sponsored and supported by by EE Publishers. wn

ANDRIES BECKER

MARTIN TERBLANCHE

DARREN CROUCHER

THEAN HOOGENBOEZEM



Hessequa Municipality

The First municipality in South Africa to become an Independent Solar Power Producer

BY I LES STUART **I** SAIEE SOUTHERN CAPE CENTRE

The Hessequa Municipality includes Heidelberg, Slangrivier, Riversdal, Albertinia, Gauritz and Stilbaai in the Western Cape. The Municipality has already taken bold steps to ensure that it remains a pioneer of energy efficiency. They were the first municipality in South Africa to install solar water geysers for low cost housing in 2008 and have received the award for Energy efficiency and Energy conservation at the Western Cape Greenest Municipality Awards ceremony in October 2011. The municipality is one of the few in the country to have retained a power producer's licence. Most municipalities closed down their power stations in the 1980's as Eskom was able to produce power cheaper than most municipalities. The Riversdal power station still runs three vintage diesel generators which are used as back-up power sources for the town. This meant that the Riversdal hospital and all core municipal services for example never experienced an interruption of power supply during the energy crises two years ago.

With the launching of this solar project the municipality is yet again taking the lead at local government level to demonstrate their commitment towards taking action to combat the effects of climate change.

Establishing renewable energy projects on municipal property has been identified by council in 2007 as one of the primary mechanisms through which the Hessequa municipality will seek to reduce its carbon footprint. This project paves the way for council to achieve its stated goal of being energy and carbon neutral by 2020.

At 16h00, on the 15th of November 2011, the Hessequa municipality started feeding 'green' solar power into the national grid. The project is a 33 kW PV Solar project located at the Riversdal water works next to the N2. The project has the potential to be expanded to a 5MW project. It is an initiative of the Hessequa municipality and was a Showcase project for South Africa at the COP17 event.

COP 17 was the 17th Conference of the Parties (COP17) to the United Nations Framework Convention on Climate Change which was held in Durban from the 28 November - 9 December 2011. The municipality will own the asset and it will be financed with grant funding from the Department of Energy. The project has been submitted under the COP17 REBID programme and is expected to be self-funding.

Renewable energy became a reality and an investment opportunity in 2008 when a programme was approved by the National Energy Regulator SA (NERSA) which offered developers the opportunity to bid at fixed tariffs to supply energy to NERSA. The process was called the Renewable energy feed-in tariff process (REFIT). The REFIT tariff offered developers fixed tariffs for their energy.

Following the announcement early in 2011 that the REFIT process was illegal, new request for proposals were issued in August 2011 by the Department of Energy.

The new process is based on competitive price bidding also known as the REBID process. By embracing the REBID process and investing in small scale distributed energy projects the Hessequa municipality has positioned itself as a potential Independent Power producer to ensure energy security for its residents into the future.

The municipality now has the potential to generate income to offset the rising cost of electricity as it is able to sell renewable energy at a higher tariff to The Single Buyer Office (SBO), an autonomous ring fenced unit within ESKOM, than the tariff at which it purchases energy from ESKOM.

As more households implement energy efficiency measures including the installation of solar water geysers, heat pumps and low usage energy luminaires, there is a potential loss of revenue as municipalities sell less electricity because residents are reducing their energy consumption.

By generating power and selling it at a profit to the SBO, council is able to reinvest in more renewable projects which will assist the municipality in keeping electricity tariffs affordable whilst reducing its carbon footprint and use the income generated towards the economic and social development of its communities.

Rural municipalities like Hessequa, with a small tax base, rely on grant funding to ensure effective service delivery. The opportunity to supplement its income stream through the development of municipal assets and acquisition of income earning assets opens the door for real developmental local government.

With the launching of this project, the Hessequa municipality is pioneering the concept that municipalities must take responsibility for directly putting measures in place to combat climate change and meet the energy needs of its residents through renewable energy.

SAPS' Renewable Energy Programme gets the "Green" light

BY I COLONEL R. BOTHA

In its 2011/12 strategic framework, the South African Police Service (SAPS) identified the need for the direct improvement of the SAPS' service delivery infrastructure, particularly in areas where the building of new police stations, and the provisioning of critical infrastructure essentials such as electricity, water and sanitation, will enhance accessibility to communities in need of police services.

With the planned rollout of new police stations already underway, SAPS recently embarked on a renewable energy programme for ensuring that the provisioning of enhanced auxiliary services, such as power at police stations, becomes a tangible reality to enable them to operate, thereby making a significant impact on the reduction of crime in affected areas.

The first of many remotely located police stations that are earmarked to receive a new Solar Energy Centre, have already been converted from a total reliance on diesel generated power, to "Green Power". Conventional grid power is non-existent in areas such as Katkop and Afsondering in the Eastern Cape, due to the remote location and rough terrain encountered in accessing these sites. "This is the first major successful Green Energy project undertaken by SAPS to enhance service delivery, whilst saving costs and protecting the environment".

The SAPS is delighted that it has demonstrated both initiative and leadership by having already embarked on a Renewable Energy Infrastructure programme, that will not only address its energy needs, but also make a significant contribution to the reduction of carbon emissions. This will create a "greener" and cleaner environment. It is estimated that, as a direct result of this initiative, carbon output will be reduced by over 190 000 kg per year.

Colonel Riaan Botha (Project Manager) advised that both local content, and support, were key considerations in awarding the tenders for the required power solution. This was to ensure that job creation, skills development and capacity building objectives were also addressed. The key focus for the SAPS was ensuring improved service delivery to the community. Having been awarded the tender to build a solution for the first two sites, Johannesburg based company, Telenetix Technology Solutions is confident that it's locally designed and

SAPS Afsondering
10kW solar array

SAPS Katkop - Staggered Array

Solar Geyser Installation

5kw Stand alone PV Array

manufactured T-Cube™Solar Energy Solution, will keep police stations operational on a 24x7 basis, 365 days of the year, without being impacted by breakdowns, adverse weather or shortage of fuel supplies.

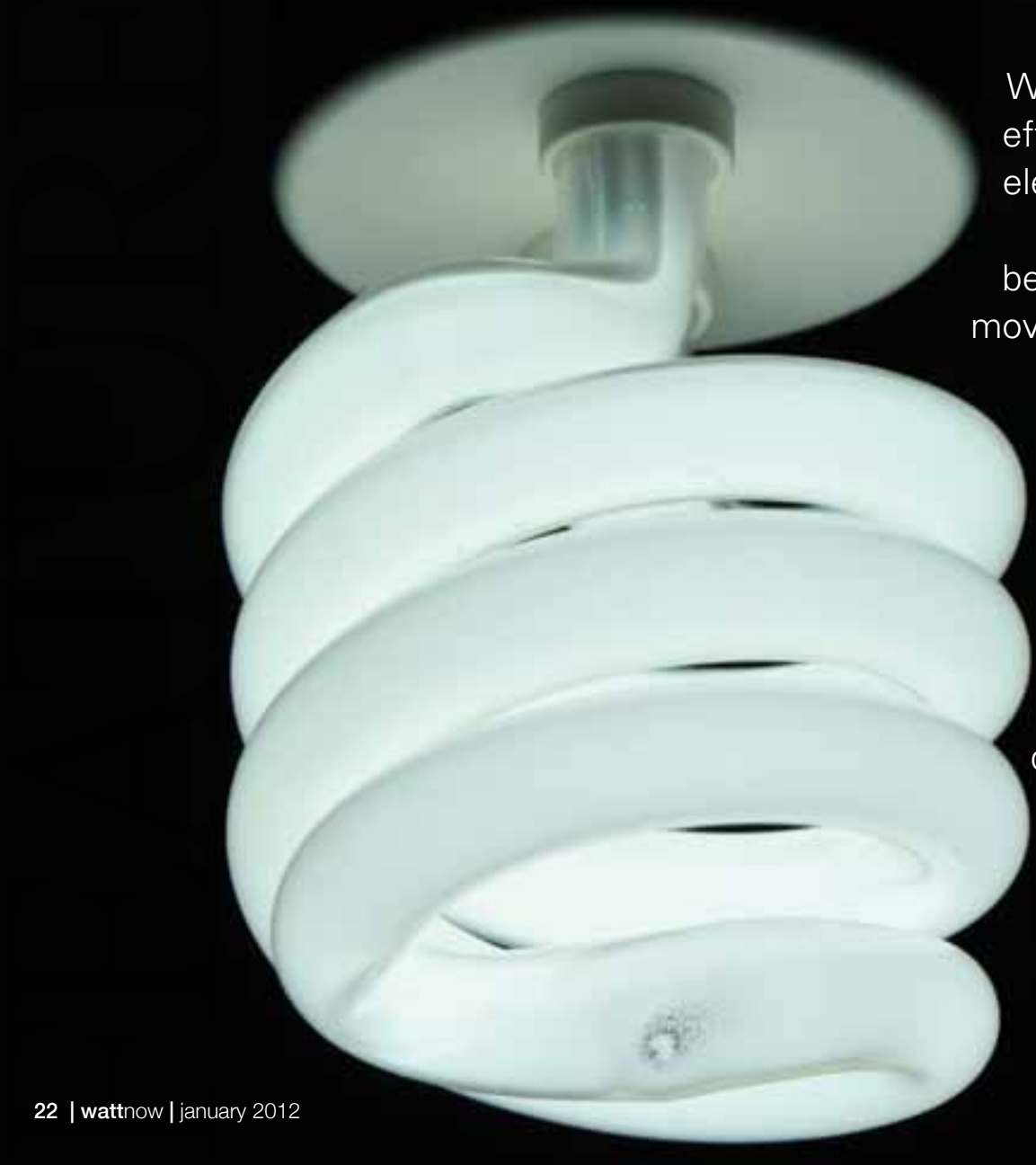
The added advantage to implementing such a solution are the financial savings that the SAPS will achieve over the solution's lifespan of approximately 10-15 years, together with reducing the pressure on future budget allocation for improving service. In furtherance of its drive toward greater energy efficiency throughout the organization, SAPS is also considering expanding the scope of the programme to include "Green" building design and similar renewable energy solutions in future rollouts of new station infrastructure.

Evidenced by the pivotal role it played in hosting a successful World Cup 2010 without incident, and the improvement in key crime and safety indicators over the last year, SAPS is a definite frontrunner through taking such progressive steps in embracing energy efficiency. This certainly augurs well for them becomming a more efficient and potent force for combatting crime within the country. wn

Earn CPD Credits

How Not to Save Energy in Lighting

BY I STEFAN FASSBINDER



When speaking of the efficient conversion of electricity into artificial light, the common belief today is that the move from conventional magnetic (inductive) to electronic gear is the first and most important step. Next, the automatic regulation by using dimmable models combined with daylight sensors and motion detectors often claims a savings potential of up to 80%.

Figure 1: *Interior of a magnetic ballast – nothing much more than an iron core and a copper winding in there*

Figure 2: *Interior of an electronic ballast – it inverts the mains frequency into high frequency, which allows for building the inductive components substantially smaller and eases the inclusion of electronic control*

Figure 3: *1966 – 115 km/h, 8.0 l/100 km*

EVERYTHING IS RELATIVE

But how plausible is this? What is being compared to what? Which is the reference basis? What does »up to« mean? Would you believe that a 25W incandescent lamp can save 75% of energy? Well, of course it can if you use it as a replacement for a 100W incandescent lamp!

Unfortunately this is exactly the principle how lighting efficiency advertisement works. Most certainly electronic dimmable fluorescent lighting does provide 80% of energy savings if it is very well done and replaces incandescent lamps - but so does fluorescent lighting with good modern magnetic ballasts! As far as the basis of comparison is given at all, the best available electronic system is always compared to the poorest and most ancient magnetic system. This is just like saying, "A Volkswagen is less efficient than a GM" *(Figure 3)* or "A GM is faster than a Volkswagen!" *(Figure 4)*.

If, for instance, a 25% savings is claimed alone for going from a magnetic to an electronic ballast for the same 58W (T8) lamp, then the basis of this comparison must be a 40-year-old ballast dimensioned for 220V and now operated on the IEC voltage of 230V, pushing up the losses in this historical ballast to no less than 19W - if what is being compared to this is the best available electronic ballast class "A2" (feeding the same lamp)! Albeit, a modern magnetic ballast only causes a loss level of 8W, and there are also electronic ballasts class "A3" around, which would cut down the difference between an electronic and a magnetic system from 19W or 25% to 6W or 8%, respectively. On top of this, the comparison ignores that the "ancient" system provided a light output of 5300 lm and the alternative electronic one only does 4700 lm!

ARE T5 LAMPS MORE EFFICIENT?

Another 25% of savings is claimed[1] for switching to the "slim" so-called T5 fluorescent lamps that have a diameter of only 16 mm rather than 26 mm. They are commonly believed to be more energy efficient than the T8 lamps that superseded the 38 mm T12 lamps over 30 years ago. As a matter of fact, they have been invented only in order to finally have a lamp in the market which can claim to be operable only with electronic ballast. Now, for the first, this wisdom has just expired. One ballast manufacturer[2] just released a new type of magnetic ballast that allows the use with T5 lamps, and one lamp manufacturer[x] specified one series of T5 lamps as suitable for direct operation at 50 Hz with magnetic ballasts. Practically it works for all T5 lamps at room temperature, but at low ambient temperatures below 0°C only the specified type will function.

DOES DIMMING SAVE ENERGY?

The greatest claims for energy efficiency are made for automated lighting systems that reduce the lighting level complementarily to the availability of daylight and shut it off dependent on the absence of persons. Unfortunately, however, several circumstances cut down the savings potential of such procedure:

- The efficiency of a light source consisting of a fluorescent lamp and a dimmable electronic ballast drops with dimming. Standards require that the power intake be no more than 50% of the full load rating when the light is dimmed down to 25% of its full level *(the one in Figure 6 already performs way better than that!)*. This is partly due to the fact that dimming requires the filaments to be heated permanently rather than only before start.
- If the control is not optimally engineered, which all too easily happens, the state of "lights off" is configured as identical to "dim down to zero". In either case, the light will be off, and the user will realize nothing uncommon; albeit the filaments are still being heated when the lights are dimmed down to zero. This may easily result in a power consumption of some 13W!
- Still, even with this not being so and the lamps as such being "really" switched off, some stand-by consumption always remains in the electronic ballasts because these must be kept on the alert to receive signals via the data line as to when to dim up / turn on again. This stand-by power consumption will reduce the intake from about 13W to maximum 1W according to present EU regulation, in future only more 0.5W,

How Not to Save Energy in Lighting

continues from pg 21

Figure 4: *2006: 163 km/h, 4.8 l/100 km*

Figure 5: *Latest development – magnetic ballasts for T5 lamps*

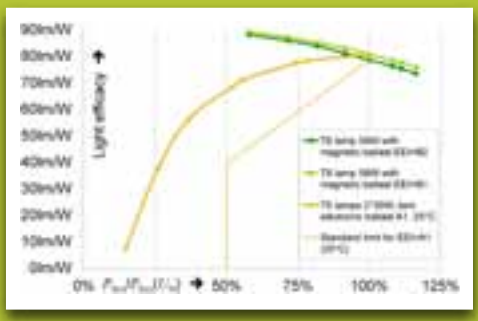


Figure 6: *Lighting efficacy plotted against the relative input power of a dimmable electronic system and a magnetic system with voltage variation*

Figure 7: *Different electronic starters for general and special applications*

As a matter of fact magnetic ballasts exhibit the opposite behaviour as dimmable electronic ones do: When reducing the power input to a lamp and ballast circuit, which can easily be achieved by reducing the feeding voltage, the losses in the ballast will drop from e. g. 8W to 2.4W!

which looks like very little, compared to the lamp power rating of, say, 35W or 58W, but power is not energy. For an office, for instance, the EU calculates with about 1300 occupancy hours a year during which the power is regulated and goes up and down between, say, those 35W (if we are dealing with an "HE" lamp) and those 13W, while for the other 7460 hours the stand-by consumption remains, so that in the end of the day only more 80% to maximum 95% of the energy are spent on lighting, while something between 5% and 20% has to be spent on keeping the light off!

HOW TO REALLY SAVE ENERGY

Dimming is a fine thing when otherwise there would be more light than convenient, but it is not the means of choice in terms of energy savings. As a matter of fact magnetic ballasts exhibit the opposite behaviour as dimmable electronic ones do: When reducing the power input to a lamp and ballast circuit, which can easily be achieved by reducing the feeding voltage, the losses in the ballast will drop from e. g. 8W to 2.4W! On top of that, the efficacy of the lamp itself improves when not driven to full power - contrary to what we observe with a dimmable electronic ballast. So when reducing the operating voltage e.g. from 230V to 190V the power intake of the whole lamp and ballast circuit will drop to about 58% of the full level, while the light output level does not drop below 64%. So the efficiency is boosted up *(Figure 6)*, while at the same time it must be emphasized that this is not a dimming technique, nor a substitute for same! The drop from 100% to 64% of brightness is hardly visible to the human eye, and a further reduction of feeding voltage below 180V is not possible, since otherwise the lamps would simply extinguish.

Quite a number of companies have been found in Europe who exploit this effect for saving energy and boosting efficiency in lighting, simply by using many different variants of auto transformers along with some sort of plain and simple or sometimes also more sophisticated control technique, which can make magnetic ballasts more efficient than electronic ones. All the other advantages of electronic gear can be covered by using the magnetic ballasts together with electronic starters[4] *(Figure 7)* rather than the commonplace glow starters:

- Optimal warm start, hence enhanced lamp lifetime,
- Flicker-free start,
- Shut-off of defective lamps, no permanent flicker.

Anyhow, speaking of a longer lamp life with electronic ballasts again yields one of these unfair comparisons where the best variant of one technology (warm start) is compared to the poorest of the other (the glow starter). Doing it the other way round, i. e. comparing an immediate start electronic ballast to a magnetic ballast with an electronic starter would deliver the inverse result! But nobody does that. Why not? wn

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2. www.vossloh-schwabe.com
3. www.auralight.com
4. www.palmstep.com – this supplier gives you a 10-year warranty on all starters!

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What makes the Apollo range so unique are a number of key design and manufacturing elements which, I feel, gives them the edge in an increasingly competitive market in South Africa. For instance, the Apollo range's simple yet effective design means that Solarport offers a single, self contained, modular unit which includes a PV panel, controller box and LED lighting bank, in a tidy package available in the powder coated finish of your choice. Their use of stainless steel and aluminium plate in the construction process means that the Apollo is very well equipped to deal with South Africa's various harsh environments and has a rated life span of about 20 years. With an operational 'up-time' of 72 hours on single charge, the purposefully over engineered Apollo insures that you'll have light even when days are dark, which seems to be an increasingly evident reality across South Africa today due to the ongoing stresses placed on our aging power utility infrastructures.

For the company's relatively short time of being active in the market, they have already managed to accrue an impressive list of clients which include the city of Durban, Spier Wine Estate and Execujet, to name a few. When asked why they chose the Apollo range as their preferred lighting solution, Cherie Immelman, group property manager for Spier Wine Estate, answers, 'Our project called for a solution that would allow us to move away from conventional, grid tethered lighting options and help promote our organisation's philosophy of showing leadership in the drive for a sustainable and carbon neutral future. Not only have we found that conventional lighting solutions are no longer financially viable for Spier due to the ever rising costs of power, but that they are also a maintenance burden on our staff due to aging infrastructure. The brief was simple. We needed a solution that not only took our outdoor lighting 'off grid', the solution also needed to have a minimum impact on the aesthetic appeal of our property. The Apollo range checked all the boxes and was thus a natural choice for us.' She adds, 'Not only has the Solarport solution met our requirements, but it's estimated that we will reduce our carbon footprint

Solarport offers unique solar lighting solution

With the plethora of solar products available today which offer solutions for various applications, I found Cape Town based company, Solarport's product offering refreshingly unique. Their Apollo range of grid independent outdoor lighting solutions can cater for a number of outdoor lighting applications from pathway lighting to larger area and road lighting, while eliminating the need for trenching, cabling and transformer costs, normally associated with projects of this nature.

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by 175 tons of CO_2 over the life span of the products, compared to similar, grid tethered options.'

Solarport also offer an impressive range of high powered, grid tethered, LED lighting solutions for commercial and industrial use. As the official sole distributors of the Sunway range of LED lighting solutions in South Africa, Solarport can offer anything from security lighting to warehouse lighting that is capable of reducing your company's lighting power consumption by up to 70% without compromising on the output and quality of light. 'We've found that the Sunway 80W LED flood light is a suitable replacement for our old 400W mercury vapour flood lights for security lighting applications. They don't have any warm up time and produce a crisp, white light which makes objects and people highly visible at night' ,says Danie Swart, Maintenance Manager for Execujet, Cape Town. The incorporation of the 'chip on board' or 'COB' LED technology developed by American chip manufacturer, Bridgelux®, means that the Sunway range is manufactured to highest international standards and provides peace of mind when deciding on a LED lighting product.

An added bonus is that the Sunway range of products has a rated life span of 50 000 hours which equates to about 17 years of use before an estimated 20% reduction in LUX output, based on 8 hours of use per day.

We asked Terence Rudge, Sales Director and partner at Solarport where he saw Solarport heading in the near future, he replied, 'We've taken our time developing our business philosophy and strategies. Our key focus is on offering our clients premium products, tailor-made solutions and professional after sales service. We plan to expand our operations to eventually service the entire Southern African region through strategic alliances with leading lighting and electrical services providers. The expansion, however, will never come at the expense of customer satisfaction because without happy customers, we will have no business to speak of.'

In conclusion I'm of the opinion that, if you'll excuse the pun, the future seems bright for Solarport. wn

The making of a green, intelligent city

M2M*is set to transform the utilities sector and the way of city life. Peng Haixing, Vice President of Huawei's Software Enterprise Business Unit, talks about M2M, and how its potential can be harnessed to build a green and intelligent city.

By Peng Haixing

Forces driving M2M

One year earlier, at the MWC*2010, we announced our determination to go beyond connecting people to pursue M2M, and beyond the pipeline for cloud computing. These two are areas of strategic focus for us. Behind the M2M agenda, there are several fundamental driving forces.

The future scale of M2M can be put into perspective by a forecast from UN, which predicts that the percentage of the global population living in urban areas will exceed 70% by 2050. There is no doubt that mobile subscriptions are riding this wave, with many people having two or more handsets. Yet the connectivity of things lags far behind that of people, with only 1% of the world's 50 billion devices connected.

This opens up the potential for a whole new connected world that involves future city living, including security, traffic, education and so on. It is expected that this market will be worth USD110 billion by 2012. With M2M applications expected to attract a flood of investment in the future, countries are currently developing their own national strategies in order to keep up.

Currently, industries like healthcare and energy are using or planning to use M2M applications. Yet, the future of M2M lies not within the confines of a single industry, but within the interconnections between industries, and these require a large-scale platform.

The value chain and business models are key elements of M2M. Operators are well placed to achieve a dominant position in the value chain, as they act as an interface between end users, content providers and application providers.

Video surveillance: A case in point

The common focus points of M2M platform include the secure connection of machines and smart applications based on sensor networking. Based on our extensive experience in video surveillance which features high-speed wireless M2M applications, we think there are four key elements to its successful operation.

Clear perception and measurement: We once had a case in which the recording system and alert system were triggered by the movement of mosquitoes drawn to the camera by its light. Adjustment of the system sensitivity brought things back to normal.

Safe access and interconnection: Security is an essential factor. Without a security guarantee, hackers can easily get unauthorized access and even take control of the whole command center.

Smart analysis and interaction: When the video data reach the data center, the center needs cloud computing equipment to generate results and provide feedback to the

sensor within a second. Therefore combining the strengths of cloud computing and M2M is vital.

Unified platform and collaboration: Currently, in some cities, we are building a connection between electronic identification (EID) and video surveillance. Standardization is the key for fast growth in this area.

Realizing the vision of a green, intelligent city

With the M2M platform holding the future, how can we realize a green and intelligent city? As we look at it, there are three important factors.

Firstly, establish a clear development plan, take into account the information requirements of the government, enterprises and citizens by unifying data access, data processing, application framework and service interface, and tailor the urban planning according to the specific environment, positioning and development emphases of the city.

Secondly, build a city that is visible, and process and utilize the information related to urban infrastructure and life-related facilities by making full use of the digital technologies.

Thirdly, build a city with unified management and intelligent collaboration by constructing a unified platform, a city data center and three basic networks of Communication, Internet and Internet of Things in a hierarchical manner to achieve a growing and scalable platform capability and application and create a future-oriented intelligent city system framework.

The four core technical elements of the intelligent city solution, are computing, video, communication and management. We have deployed thousands of people in the past three years to build this platform in order to make it simple and open enough for the ecosystem to build applications on it.

Each year, we hold a partner conference for the vertical application environment (VAE) platform. We are now working closely with ETSI M2M standardization team to build the M2M platform architecture and standard. M2M holds the future for each one of us. We are ready. Are you? wn

Editor: Zhu Wenli zhuwenli@huawei.com

> The value chain and business models are key elements of M2M. Operators are well placed to achieve a dominant position in the value chain, as they act as an interface between end users, content providers and application providers.

* *M2M - Machine to Machine*
* *MWC - Mobile World Congress 2010*

Earn CPD Credits

Ethernet in the Utility Market

In recent years the utility market has been moving away from serial and towards Ethernet as its communication network of choice. Using Ethernet, interoperability between various vendors is much easier, as the lower levels of Ethernet call for standards of how data packets are constructed and sent across the network.

BY I TIM CRAVEN

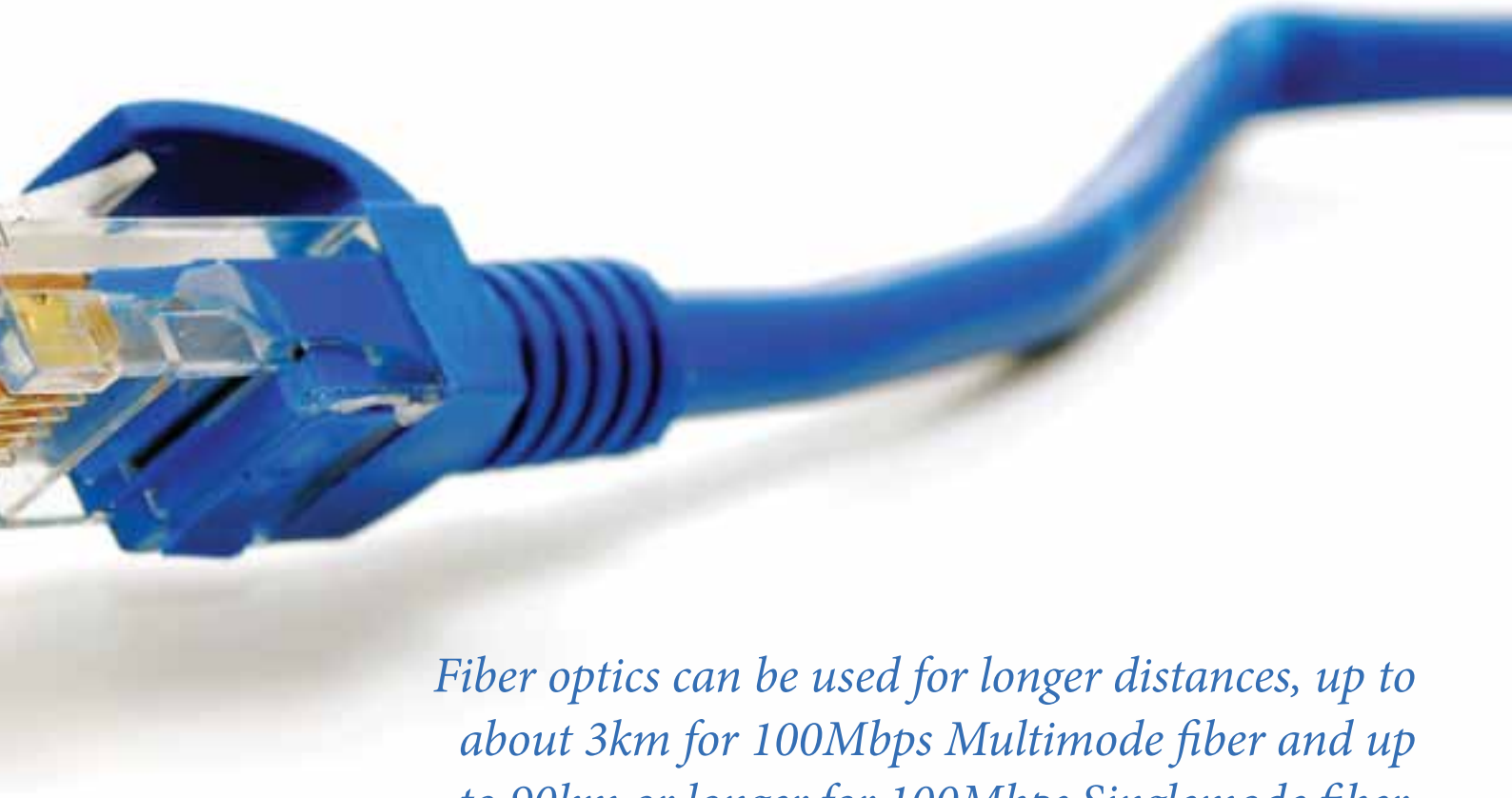
Different applications will often still use proprietary protocols at the higher levels; however the way the data is transmitted on the network is the same.

The industrial market has been following the same trend, also moving over to Ethernet, although the industrial move has been a lot easier due to there generally being less remote legacy devices in the industrial world, which means less devices that have to be replaced or converted for compatibility with an Ethernet network. The industrial sector is also more forgiving when arranging scheduled downtime for installation of new hardware or expansion of the network.

Serial connections have many limitations, including distance, susceptibility to EMI (Electro-Magnetic Interference), slow transmission speeds and of course lack of interoperability between different vendors and protocols. Ethernet introduces many new protocols and mediums of communication to lessen or negate these limitations.

Serial allows for a maximum distance of around 1.2km (Depending on many factors, such as environment, protocol, speeds required etc.) Longer distances means lower speeds, as well as being more affected by EMI etc. meaning planning must be done to make sure that the required speeds and data reliability are achievable, and that the connection will be stable.

Ethernet extends this distance almost indefinitely (Depending on application, and locations of end points etc.) by providing many different mediums. The medium used



Fiber optics can be used for longer distances, up to about 3km for 100Mbps Multimode fiber and up to 90km or longer for 100Mbps Singlemode fiber.

will depend on the application, and what is required. For instance over short distances (Such as within a patch panel/control room) a Cat5e (Category 5 Extended) or Cat6 cable would be used. Fiber optics can be used for longer distances, up to about 3km for 100Mbps Multimode fiber and up to 90km or longer for 100Mbps Singlemode fiber. If distances of even greater than this are required, options are available for dedicated satellite links, or for less mission critical applications cellular routers can be used to connect to the Internet, and from there data can effectively be sent anywhere in the world that has Internet connectivity.

Due to serial communications mostly taking place over copper based wiring, these links are highly susceptible to EMI. In the utility environment this is especially a concern due to the high voltages and EMI produced. Ethernet can lessen the impact of EMI by using fiber optic cabling as opposed to copper cabling, as fiber optics are completely immune to EMI. Although the actual Ethernet devices themselves can still be affected by EMI, some manufacturers do eliminate this by providing specially shielded products that provide resistance or even immunity to EMI.

Serial communications have extremely limited speeds, or baud rates (Symbols per second). Depending on the hardware, and software speeds can reach up to around 1Mbps. These speeds drop dramatically as we increase the distance of the serial link. However, even over an extremely short link (<5m) the maximum achievable speed of around 1Mbps is nowhere near to the speeds provided by Ethernet, which allows speeds of up to 10 Gbps (Or even higher if we aggregate multiple links together). As serial is mainly used for communications between a small number of devices with very small amounts of data these low speeds were not a problem. However Ethernet can be used to create networks covering a whole substation and, with the correct planning and configuration, can be used to send data between all devices on the site. With this allowance for so much more data than that provided by serial, devices can now send and receive that much more data, allowing for more advanced protocols and device management.

As stated, Ethernet also allows for much better interoperability between devices. The reason for this is that Ethernet is an open standard, and devices that support Ethernet must support this standard (IEEE 802.3). This means that different manufacturers' Ethernet devices will always be able to transmit and receive data between one another (Although whether

they can understand the data depends on the protocol being used). Different manufacturers may use proprietary higher level protocols, however these protocols will still be packeted and sent on the network with the same specifications as a different manufacturers protocols. This means that a single Ethernet network can be constructed to cater for whatever data is required. However more planning than serial is required for creating an Ethernet network, as details such as required data rates, number of devices per switch/device and so on are required.

Ethernet networks allow for much easier expansion than serial does. By simply adding new switches to the existing network, more ports and thus more devices can be catered for. If a higher bandwidth backbone is required due to increased traffic amount, multiple links can be aggregated together to provide the required bandwidth.

Another downfall in serial is the lack of redundancy provided. Although some devices will come with a redundant serial port, generally serial devices only have the single port. This means that any cable breaks can potentially cause devices to become unreachable, which can lead to serious problems, downtime or in extreme cases even death if protection devices fail. Ethernet caters for many different kinds of redundancy. Using protocols such as RSTP (Rapid Spanning Tree Protocol) redundancy can be provided, up to a level required by the application. This redundancy means that in the case of a cable break, traffic flow can be redirected to allow all devices to still be reachable.

HSR (High-availability Seamless Redundancy) and PRP (Parallel Redundancy Protocol) are two newer redundancy protocols that provide redundancy in different ways.

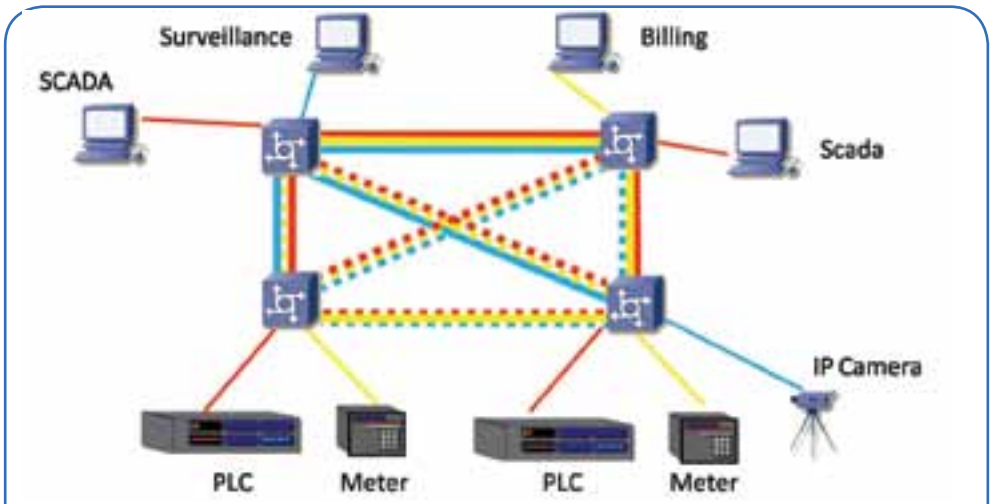


Figure 1 - Example of an MSTP Configured Network

HSR works by sending the same data in two directions around a ring or mesh network. The receiving node on the other end of the network will simply discard the data that arrives second. In the event that there is a break in the network, one set of data will still be able to get through to the receiving device.

PRP goes so far as to run two completely separate Ethernet networks redundant to one another. This means that even in the event that one network catastrophically fails the second network will be able to pick up the load almost instantaneously, meaning no data is lost in the changeover.

Ethernet also allows for much more control over the traffic flow on a network. Using protocols such as VLANs (Virtual Local Area Networks) we can segregate data based on which group of devices needs to receive the data. For instance we could have control, protection and surveillance all running on different VLANs, meaning that devices in the control VLAN would not be affected by traffic in the protection or surveillance VLANs and vice versa. When using VLANs it is important to make sure that the network backbone can cater for the total amount of traffic of all VLANs combined.

We can then go even further by combining redundancy along with VLANs to achieve load balancing on the backbone using a technology called MSTP (Multiple Spanning Tree Protocol). MSTP provides redundancy using RSTP, but rather than having the same redundant link for all VLANs (which then means that link is unused except in cases where there is a cable break),

MSTP provides a different redundant link for different VLANs. For instance VLAN 1 could be using a link that VLAN 2 is not using, and vice versa. MSTP therefore allows for much greater control over the traffic flow on the network backbone, whilst still providing the high-speed recovery provided by RSTP in the event of a cable or hardware failure.

Figure 1 - Example of am MSTP Configured Network

Generally Ethernet is not considered deterministic, as due to the number of devices and variable traffic flow on a basic Ethernet network it is difficult if not impossible to determine a reliable time frame in which packets will transfer between devices. With the correct planning and configuration certain traffic on the network can be made deterministic.

Using IEEE1588v2 aka PTPv2 (Precision Time Protocol v2) all PTP enabled devices

on the network can be synchronized to within 1 µs (microsecond) of a master clock. This allows for much more accurate timing and monitoring of the transmission speeds of the packets. This alone will not make a network deterministic; however it is the first step in getting deterministic traffic. PTP is extremely valuable for applications that require precise time measurements, such as synchrophasor readings.

A second technology that, in conjunction with PTP, can add to the determinism of a network, is prioritization. This works by assigning different priorities to different Ethernet packets. A packet that has not already been assigned a priority will be assigned one based on the first of

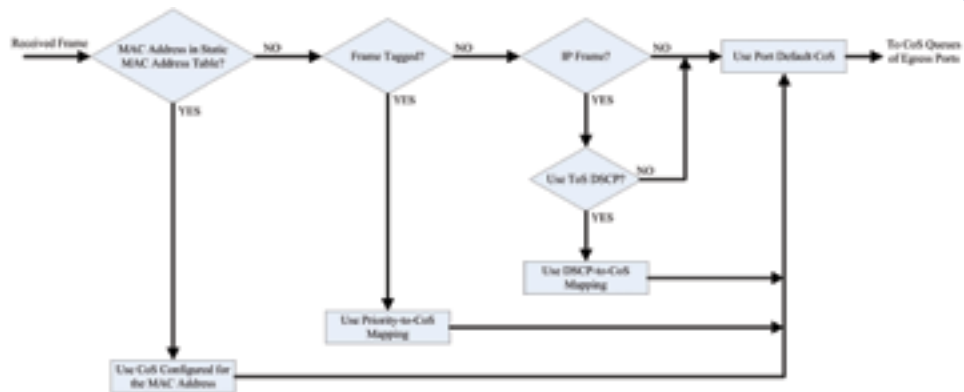


Figure 2 - Prioritisation Flow Chart

the following inspections that has been configured and enabled by the user:

- By the ToS field in the IP header – This prioritization must be assigned by a layer 3 device, however it can be inspected by a layer 2 device (A switch).
- Priority field in the 802.1Q tag – Once again this field must be assigned by a layer 3 device, however a switch can inspect this field and prioritize the packet accordingly.
- Source or destination MAC address – The switch will check its static MAC table and assign a priority to the packet if so configured.
- By ingress port – The switch will assign the packet a priority based on the port it enters the switch on.

Figure 2 - Prioritisation Flow Chart

There are two methods to determine how to deal with prioritized packets. Most manufacturers will offer both of these methods in their devices; however some manufacturers will only support one or the other. Each of these methods has its own pros and cons.

The Strict or Starve method of handling prioritization works by first transmitting all higher priority frames before moving on to the low priority ones. The pro to this method is that all high priority packets are given the most attention, ensuring that all high priority packets are sent ASAP. The con is of course that if there are too many high priority packets then lower priority packets can potentially never be transmitted.

The Weighted Fair Queuing method involves setting a queuing configuration (Normally 8:4:2:1) for sending the packets in a fair ratio. This setting will send up to 8 critical priority packets, 4 high priority, 2 med priority and 1 low priority packet at a time. (It can send less if there are not enough packets of that priority, i.e. it will not hold off sending data until all queues are full). The pro to this is that all data will have a chance to be sent, no matter what the traffic amounts are like, however the con is that critical data could potentially be delayed depending on the rest of the traffic on the network. Using these different protocols certain critical data travelling on the network can be made to have deterministic like behaviour, in that we will be able to determine a time frame wherein the packet must be transmitted from one device to another.

So we can see that the overall benefits and ease of use provided by Ethernet far outweigh those provided by serial. Ethernet is definitely the next logical choice for all industrial, utility and ITS networks, and with the proper understanding and configuration can be an extremely powerful technology for the transmission of data. With the redundancy, time synchronization, prioritization and other protocols available, Ethernet can reliably be used for critical data networks and extremely time sensitive applications. Due to the open standards, many different vendors' Ethernet based hardware can all be combined on the same network, saving on costs for cabling, hardware etc. Ethernet is definitely the network of choice for the present and, due to its popularity and expansion on a world-wide scale, it can be expected to stay that way for the foreseeable future. wn

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The Swimming Pool Pump

Applying fundamentals to reduce energy use dramatically

While standby generators are the most effective form of providing power in the event of outages or load shedding, one of the most neglected, but essential elements of generator operations, is ensuring that the diesel fuel in the standby tanks is uncontaminated.

BY | T. C. VERSTER

There are more than 500 000 domestic swimming pools in South Africa, and practically all of them are fitted with filtering equipment designed for the pre-2008 era when electricity consumption was a secondary consideration. For many home-owners this means that the cost of maintaining a clear pool can exceed the cost of hot water production*a. For Eskom it represents a big slice of the supply to such households, and little has been done to tap this potential source of electricity savings to ease their precarious supply margin. In addition a growing number of people are being driven by a need not only to save cost, but to make their pools more eco-friendly. This includes reducing both its carbon footprint and the use of harmful chemicals to sanitise the water.

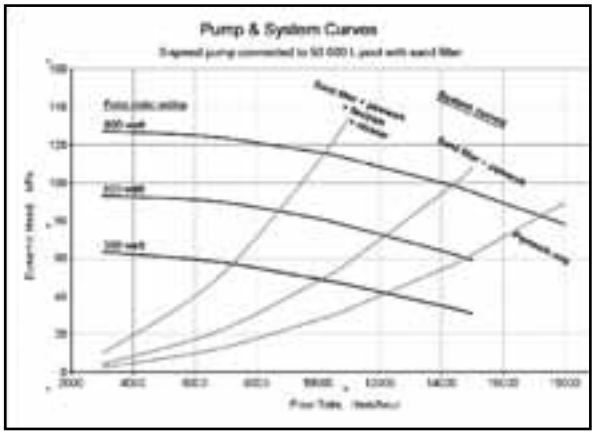
The loose existing guidelines for pump motor size and operating periods (e.g. 8 hours/day in winter, 16 hours/day in summer) are the main cause of costly wastage of electrical energy, and with some basic know-how significant improvements can be made. In addition, a new variable speed pump motor has appeared on the market, which offers new possibilities for energy-efficient water filtering. An investigation was carried out at an existing swimming pool to determine the criteria for minimising energy usage, without compromising the water quality.

If these new guidelines are disseminated more widely, amongst others, by pool shops to customers for new pools or the replacement equipment market, this sector can become the prime success story in domestic appliance greening.

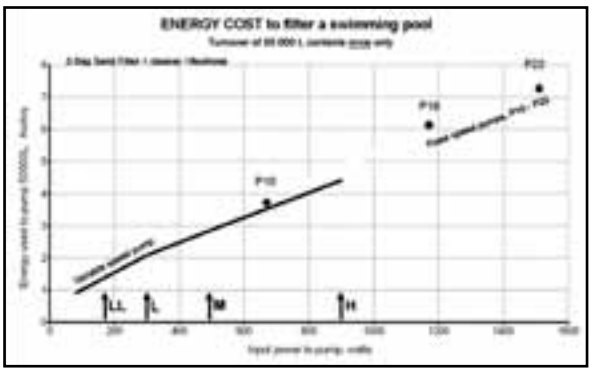
LOOKING AT FUNDAMENTAL PUMP CHARACTERISTICS

An example of this new type of swimming pool pump was obtained and installed at an existing 50 000 litre domestic pool, for evaluation purposes. This pump is driven by a brush-less dc motor, of which the rotational speed can be varied digitally over a range of >> 2:1 and a corresponding much wider power range of > 10. This particular model is supplied with a 3-speed manual control.

The pump characteristics for each of the 3 speeds, as shown in the figure below, were provided by the manufacturer. The energy consumption for each speed was measured with a conventional domestic kWh meter. The three different system curves, being



quadratic functions, could be determined by making only one flow rate measurement for each condition (system). Any type of further pump curve can be added without the need to physically install the pump itself in order to determine how much water it will pump in this particular system. The power input of any such pump need to be known, or measured, because often only the output power is given. It should be realised that there is a significant difference between the two for small/medium conventional induction motors. The brush-less dc motor has a much higher efficiency. By using data obtained in this way a very insightful graph can be plotted, which is particular to this specific swimming pool and filtering installation, but the trend is general.



OBSERVATIONS

The first observation is that a strong pump is very wasteful in energy usage, and even by just downsizing the conventional pool pump from a nominal 1100 Watt (P22) to a smaller nominal 450 Watt (P10) the same volume of water will be moved through the filter at only 50 % of the previous energy consumption. Filtering will also be more effective because the water movement through the sand is slower. As a matter of fact, the smaller motor can drive the automatic cleaner as effectively as the big motor.

The most important fact conveyed visually, however, is that there seems to be no real lower limit to the energy

The Swimming Pool Pump

that will turn the pool water around for filtering purposes, and in the extreme a variable speed pump with digital control can be set to run continuously at very low speed/power, and to only speed up occasionally for a short period to operate the automatic cleaner, which needs at least 100 Watt to function. See results further on, of an experiment to determine how long such a cleaner needs to run daily.

Note that the key effect here is variable speed, and not motor efficiency, which contributes only a minor share to minimising energy for pumping a fixed volume of water.

Also very significant is the "unintended energy demand result" of automated sanitisers like salt water chlorinators, UV exposure, and oxygenator/ionisers, which prescribe varying, but long, periods of water flow irrespective of the strength and consequential energy usage of the pump. A minimal energy pump setting seems to be the answer to this dilemma, and will enable total eco-friendly swimming pools that have very small carbon footprint, and chemicals-free water.

A LONG TERM EXPERIMENT WITH FILTERING AND AUTOMATED CLEANER TIME PERIODS

Because it is difficult to find out why private pool owners are advised to run their automatic cleaners and filters for so many hours every day, it could be helpful to look at an 8 month history (half a winter + half a summer) of a medium-sized pool (50 000 litres) in a city garden, where a focused effort was made to maintain it to a similar standard as neighbourhood pools, but using 5 % of the energy, or less.

Basically energy is required to sweep or suck the bottom clean and deposit the waste material (dust/sand, leaves, dead algae) into a strainer or filter. It is also necessary to circulate water through a fine filter (most commonly sand) to catch suspended particles. An automatic pool cleaner was attached during this experiment, but no other devices. Sanitising and algae control was done manually. The same adjustable 3-speed pump was used for the experiment, and it was found that the lowest setting (300 Watt) could still drive the pool cleaner with vigor, with a circulation of 7300 l/hour through the system.

In summary: a 300 Watt pump is sufficient to drive a pool cleaner system for long periods, but if the pool is in a bad shape, it will need the medium or high setting and a few back-washings to clear it up first. The cleaner moves at a speed of 4 meter/min across the bottom, and can theoretically sweep the pool in less than 30 minutes. In practice, with some prodding not to skip some areas, one hour is sufficient. The clarity of the water was as good as that of neighbouring pools that filtered for extensive periods daily. It was thus demonstrated over a prolonged period (8 months) that it is possible to maintain this pool, running the filter pump for only one hour per day, on average, and using less than 10 kWh/month.

To appreciate the significance of this, the table below displays the range of energy cost across different sizes and types of pump motors, run for different daily periods.

The bottom line is therefore that the energy cost of a domestic swimming pool can be reduced dramatically without sacrificing water quality, and for some installations the price differential between mature*2 and new*1 pump motor technology can be recouped in less than a year, depending on requirements. It has been shown that long hours of swimming pool filtering and automatic cleaner operation to maintain clean internal surfaces and clear water is unnecessary and wasteful in energy usage. A low power pump motor (300 Watt) can drive a cleaner as effectively as a strong motor (1100 Watt), and one hour's operation per day can be sufficient for a medium-sized domestic swimming pool (50 000 liters). If pool chemicals are manually administered, no extra pump time is required, and the monthly energy requirement to maintain the swimming pool, can be as low as 10 kWh. If in-line sanitising is implemented, additional energy will be consumed, because longer water circulation times are required, but in view of the previous analysis there is hope that this unintended energy demand can also be drastically reduced, to the same level as that of the automatic cleaner.

In final analysis: the stage is set for the domestic swimming pool to become more frugal in energy usage (< 50 Kwh/mo) than the family fridge, and simultaneously more

COMPARATIVE ENERGY USE FIGURES

Pump motor size	1 hour	2 hours	4 hours	8 hours	16 hours	24 hours
300 w *1	**9.0**	**18.0**	**36.0**	72.	144	216
450 w *2	**20.1**	**40.2**	80.4	160	322	485
750 w *2	**32.0**	51.1	102	204	409	613
1100 w *2	45.2	90.5	181	361	720	1083
1500 w *2	52.4	105	210	420	840	1259

Daily operation of filter pump, and monthly energy usage, Kwh/month

Note 1 This is the power consumption of the variable speed Badu Eco Touch on its LOW setting. The motor efficiency is > 90%

Note 2 This is the marked output power of these conventional induction motors, with efficiencies varying from < 70% to around 80%, depending on size.

eco-friendly and health-friendly than in the past, by not bringing harmful dissolved chemicals into contact with human skin and garden plants. Is it far-fetched to foresee a future day when drinking water from the swimming pool is preferable to water from the tap?

REFERENCES

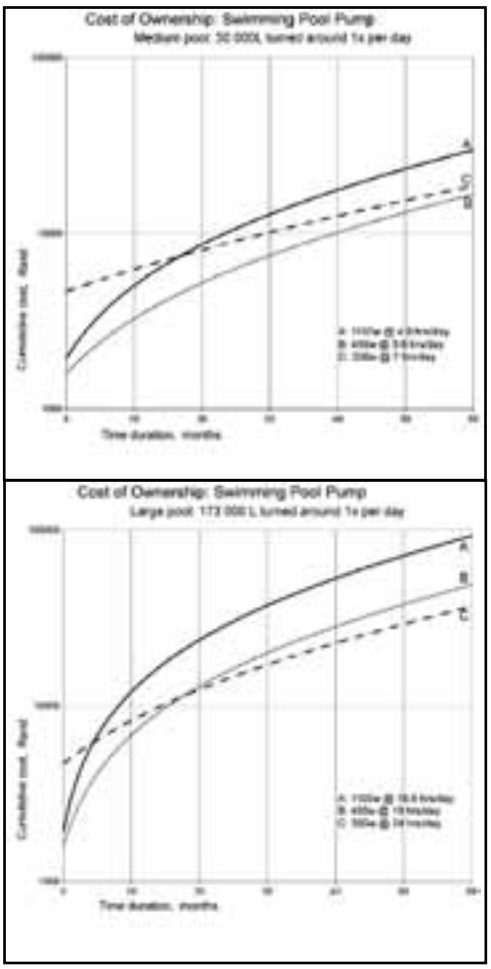
a. *T. C. Verster: Geysers - How to evaluate different energy-saving strategies, WATTnow, February 2010, pp 18 – 27.*

ADDENDUM:

The technical analysis above is necessary to show the general trend, the amount of energy basically required for any specific combination of pool appliances and run times, and avoid the trap of misleading statements. This allows the pool owner to follow an energy-efficient strategy, and minimise the carbon footprint, without sacrificing quality of pool enjoyment. In addition to this he needs to be able to calculate the economics of replacing his old pump with a new one and choosing a strategy that is also cost-effective, if possible. Three different cases will be compared, based on present-day prices, tariffs, and expected escalation factors, which may be out of date in future years, but which can then be suitably adapted, if necessary.

- ***Case A:*** A 1100 Watt pump (retail price: R1949.00), marked P22 on the energy cost graph above, is set to run for 4.8 hours/day, which will turn 50 000 litre around once every day (with sand filter, flexi hose and automatic cleaner connected).

- ***Case B:*** The owner simply replaces the existing pump with a smaller and less powerful pump of 450 Watt (retail price: R1599.00), marked P10 on the same graph, and sets the timer for 5.5 hours/day. The automatic cleaner still runs satisfactorily, and the same volume of water is circulated through the filter (50 000 l/day).



- ***Case C:*** The Eco Touch variable speed pump (retail price: R4699.00) is installed, and programmed to work for 7 hours/day on the LOW (300 Watt) setting. The water circulated is still 50 000 l/day, and the pool cleaner still works properly.

COMMON ASSUMPTIONS:

Electricity tariff: R1.20/kWh (Aug. 2011)
Escalation: 20 % pa. (until 2020)
Interest rate: 9 % (investment account)

The cumulative cost of ownership, including present purchase cost with interest, and monthly electricity cost, was calculated for each of the three cases over 5 years, with the result shown graphically.

In the case of the medium-sized pool the apparent best choice is pump B, but after 9 years B and C become equal. In the case of the large pool, for which pump C is fully utilised for 24 hours/day to turn the larger volume of 173 000 litres around 1x per day, the two lines cross over at 18 months.

It should be kept in mind that the 300 W pump (LOW setting of the variable speed Eco Touch pump) always needs less energy to pump the same volume of water (44 % less), but also becomes the most economic choice when fairly heavily used, like 8 – 24 hours/day.

This is the most conservative way to compare the energy use and cost of ownership of different pumps. In practice the outcome will always even be more in favour of the low power pump, due to the common practice of setting the timer for a fixed period of time irrespective of the size of the pump. If the curves for the large pool above, for instance, are extended to a time span of 9 years, with no timer control (24 hr operation), which often occurs at resorts, hotel pools or even koi ponds, the cumulative cost of ownership will be as follows:

- 1100 W induction motor pump: R360 000.00
- 450 W induction motor pump: R165 000.00
- 300 W setting, brushless dc motor pump: R93 000.00

The variable speed pump therefore can lead to huge savings in situations like this, and although it runs mainly in the low energy mode, it can instantly be switched to a higher speed for ad hoc tasks needing higher pressure or suction capability, beyond what a small fixed speed pump can do. Such tasks (robust back washing, vacuuming, pool emptying) are usually of relative short duration and do not significantly increase long term energy usage.

Large pools, particularly public pools, usually do not have an automatic cleaner attached all the time like the domestic pool which formed the basis of this analysis, and will therefore pump about 40 % more water per time unit, which is a bonus, but will not affect the cost of ownership figures above for continuous (24 hrs/day) pump operation. wn

BY | PATRICK O'HALLORAN BTECH **|** MANAGER TECHNOLOGY SERVICES AT CITY POWER **|** JHB

Live-line transmission lines upgrade projects

PHOTOGRAPH BY ANDREAS AVRABOS

FIRST-IN-AFRICA PROJECT

This paper covers live-line (energized) techniques for upgrading and maintenance of high voltage transmission lines without any supply interruptions. "Barehand" and "hotstick" energised techniques, coupled with patented robotic arm technology, eliminate power supply interruptions during overhead transmission and distribution line maintenance, refurbishment and upgrade work, which avoids the cost of right of way acquisition, line switching, earthing (grounding) and outage scheduling. Until recently these techniques would only have been employed in the United States and Canada. Now these techniques are being utilized in South Africa for City Power.

City Power Johannesburg has an internal 88kV transmission network which is now roughly 65 years old. The condition of this transmission network has become unreliable and based on the age should actually be replaced. Due to financial constraints this is not an option and other solutions had to be considered.

Frequent line faults were experienced due to either insulator flashovers or conductor failures. Johannesburg is exposed to some of the highest magnitude of lightning strikes, which over many years have stressed and weakened the transmission network even further.

Increased electricity demand within the City Power supply area had caused many of these old transmission lines to become overloaded. These transmission lines now had to be upgraded to cater for the current and future loading requirements. The Soccer World Cup 2010 also happened in the middle of winter and the expected load requirements for this period was also going to push networks to their extreme limits, if not upgraded in time.

The design capacity of the existing transmission lines varied from 60 to 100MVA. The old lattice tower designs 1930s and constructed in 1950s could only handle a maximum of 100MVA with conventional sized conductor. Current servitudes could also not cater for any new transmission lines and it was not possible to increase the current servitude sizes. City Power's master plan identified key network upgrade projects that had to be undertaken to avoid serious network overloading. Increased power had to be made available at substations deep within the City Power network and this meant that transmission lines capacities had to be increased.

Live-line transmission lines upgrade projects

continues from pg 37

TRANSMISSION LINE UPGRADE OPTIONS CONSIDERED

The highest priority of the 88kV circuits were the Kelvin Cydna circuits one to four from the Kelvin Power Station to the Cydna Substation that had to be refurbished and upgraded from 100 MVA to 200 MVA while reducing thermal sag. These transmission lines supply power to the Alexandra, Cydna and Rosebank substation areas.

It was also agreed to in future standardize on 200MVA capacity lines for all other existing lines to ensure adequate capacity throughout City Power's transmission network as the demand increased throughout the area of supply. This meant that the current transmission network capacity would be doubled eventually throughout City Power's network.

To achieve this doubled capacity on the existing transmission network the following upgrade options were considered:

- Increase the tension of the conductor on the existing transmission lines,
- Increase the size of the conductor on the existing transmission lines,
- Install new tower with bigger conductor to replace the existing transmission lines,
- Increase the system voltage from 88kV to 132kV to increase the system MVA,
- Install new high temperature conductor on existing old towers in the conventional way,
- Install new high temperature conductor on existing old towers live-line, and lastly
- Install new HV cable systems.

OPTION CHOSEN TO RESOLVE THE TECHNICAL AND COMMERCIAL CHALLENGES

Based on all the options above, it was agreed that the most technically and financially viable solution would be to reconductor the existing lines with high temperature conductor under live-line conditions.

Summary of options	Requirements of options
Reconductoring with larger diameter conductors or increase the tension on existing conductors.	Towers designed in 1930s. Considering current tower condition they would not able to handle additional loading with existing span lengths.
Reconductoring existing towers with high temperature conductors the conventional way (off line).	Extended outages required. Not possible due to network loading.
Reconductoring existing towers with high temperature conductors live-line	Never been done in Africa. Expensive compared to the conventional way of reconductoring.
Rebuild lines and install new towers with larger conventional diameter conductor	Extended outages required. Not possible due to network loading. Towers to be changed.
Increase the system voltage from 88kV to 132kV	Towers, power transformers and related switchgear to be changed. Very expensive.
Install HV cables	Very expensive option compared to all of the above options.

Table No. 1: Summary of the options consider to upgrade the existing HV transmission lines

Kelvin to Cydna 88kV transmission lines

The four double-circuit 88 kV transmission lines had to be refurbished and upgraded under live-line (energized) conditions while retaining the existing towers. City Power Johannesburg contracted the Edison Jehamo Power (EJP) with Quanta Services / Allteck Line Contractors (NYSE: PWR) which is a First-in-Africa project completed energized.

Mott MacDonald (Merz and McLellan) consultants where appointed by EJP to conduct line survey, conductor assessments, tower load calculations, refurbishment requirements, specialised hardware and fittings requirements, and live-line approach distances calculated to IEEE standards.

Various high-temperature conductors were reviewed before CTC Cables' ACCC Lisbon aluminum conductor carbon composite core, able to run at up to 180°C under peak loading conditions without clearance infringements, was selected.

The old porcelain and glass insulators were replaced with new composite silicon insulators which have increased

CTC Cables' aluminum conductors carbon composite (ACCC) conductor

Old porcelain insulators that were replaced with composite silicon insulators

New ACCC conductor being pulled in with old conductor

creepage requirements for the same length of insulator.

LIVE-LIVE WORK UNDERTAKEN BY EJP AND QUANTA SERVICES / ALLTECK

The conductor, insulators and all line hardware and accessories would be installed under live conditions to prevent service interruption or rerouting of the load. This process had only been undertaken previously extensively in the United States.

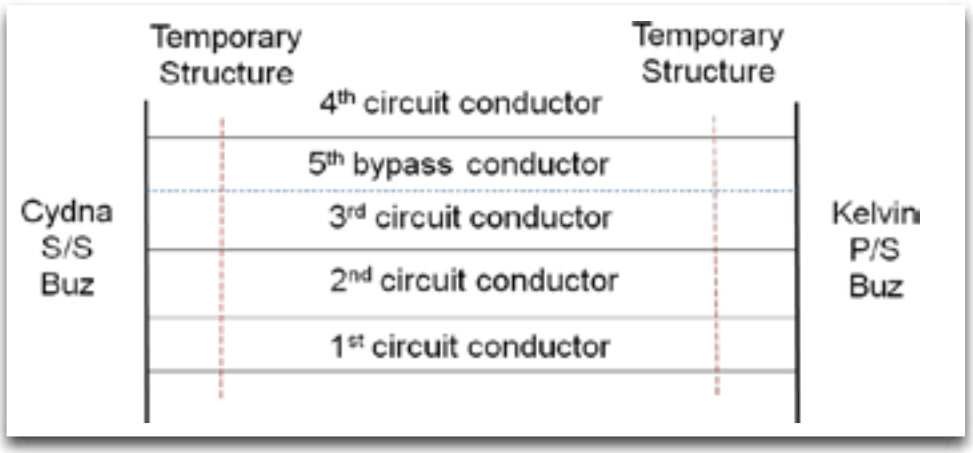
The live-line work entailed installing an additional bypass circuit (including new fittings, insulators and assemblies) to the tower and using transposition/temporary structure points to switch between circuits. This allows all four circuits to be kept alive while the fifth bypass circuit is used to do the refurbishment.

The one circuit is now into the new temporary position. The new ACCC conductor is pulled into place with an insulated guide rope and secured in position.

Once the load has been transferred to the bypass conductor/circuit, the new ACCC conductor is pulled safely into place with the old de-energized conductor.

The two types of live-line work entailed in the process were "hotstick" and "barehand.". The hotstick techniques are traditionally used for tasks such as moving conductors, installing fuses and opening and closing switches.

Barehand work, involving more intricate repairs, entails the use of specially designed protective gear enabling live-line workers to work at the same electrical potential as the line. Workers can handle and repair live-lines up to 765 kV. In the past, this method has enabled Quanta Services to repair a U.S. nuclear plant's 500 kV substation switches in one day without shutting down the reactor, saving the utility an estimated $10million.



Typical arrangement with bypass circuit and structures in place

Bypass conductor in position to allow load transfer from conductor to be replaced

Hotstick technique being utilized to test insulators prior to approach

Live-line transmission lines upgrade projects

continues from pg 39

The suit consists of a hooded jacket, overalls-style pants, socks and gloves. It is made out of Nomex, a fire-retardant material, and stainless steel fibres. This metallic mesh serves as a Faraday Cage, which puts the line worker at the same potential as that of the conductor on which he is working. With the metallic mesh clothing bonded to the conductor, the lineman can work protected inside the electrical field.

The live-line bucket is elevated and leakage current is tested by touching a wand to the conductor. Linemen are then hoisted to the level of the conductors and Quanta Services' patented LineMasterTM robotic arm, remotely controlled by an operator on the ground, approaches the conductor, which is trapped by means of a hotstick.

Once all the lines are captured and the robotic arm has taken their weight, the insulation assemblies are detached. The robotic arm moves the conductors away from the tower, and redundant fittings are replaced with new suspension assemblies bare-handed. The linemen then bond on to the conductor and install the new assembly.

Special wedge crimp dead ends and ferrules are installed on the ACCC conductor. The carbon composite core provides the support for the aluminum conductors when the temperature increases, therefore it is essential to secure the composite core in the wedge and then crimp over the entire assembly.

Live-line worker touching a wand to the live conductor to be at the same electrical potential as the line voltage

Barehand technique being utilized to install line dampers

Dead end wedge crimp connectors

LineMaster robotic arm being utilized to hold and manoeuvre live conductors

Dead end wedge crimp connectors

DESCRIPTION	DISTANCE CIRCUIT LENGTH (km)	NO. OF CIRCUITS	YEAR COMPLETED	CONDUCTOR TYPE	TOTAL LENGTH OF ACCC INSTALLED LIVE-LINE (km)
Kelvin to Cydna Circuit 1, 2, 3 & 4	16.8	4	2010	Lisbon	201.6
Delta/Westfield/Kelvin Circuit 1	12	1	2010 (Emergency repair before SWC 2010)	Lisbon	36
Delta to Delbank Circuit 1 & 2	1.26	2	2011	Lisbon	7.56
Orlando to Hursthill Circuit 1 & 2	10.8	2	2011	Lisbon	64.8
Kelvin to Gresswold Circuit 1 & 2	11.35	2	Installing (Completion early 2012)	Lisbon	68.1
TOTAL					**378.06**

Table No. 2 summarises all the HV 88kV transmission lines that have been installed. To date almost 400km of CTC Lisbon high temperature conductor has been installed in a 2 year period.

SPECIAL PROJECT THAT WAS UNDERTAKEN AFTER A CAR ACCIDENT

During the Soccer World Cup 2010 Tournament, a freak accident occurred when a vehicle travelling on a highway off ramp crashed through the Armco barrier and caused extensive damage to an 88kV transmission line lattice tower. The tower was held in place by the weight of the conductors only.

This tower had to be replaced urgently and because of the network loading conditions it could only be replaced under live-line conditions.

The below pictures show the critical stages of this urgent tower replacement project.

CONCLUSION

The use of new live-line techniques and equipment is critical to ensure the improved performance of overhead line transmission networks.

These projects would not have been so successful if live-line work methods where not utilized.

Damaged tower being removed while conductors are still energized

Live-line transmission lines upgrade projects

continues from pg 41

The new ACCC high temperature conductors allow utilities a viable solution to upgrade existing overload overhead transmission lines.

Although the project is done all live-line it is actually safer than de-energized work, as all the safety requirements are in place to withstand an accidental flashover.

Lastly, it is essential for projects of this critical nature that strategic partnerships be formed with companies who have a proven track record to perform this live-line project without any incidents. wn

New tower being installed while conductors are still energized

New tower in position with no supply interruptions experienced

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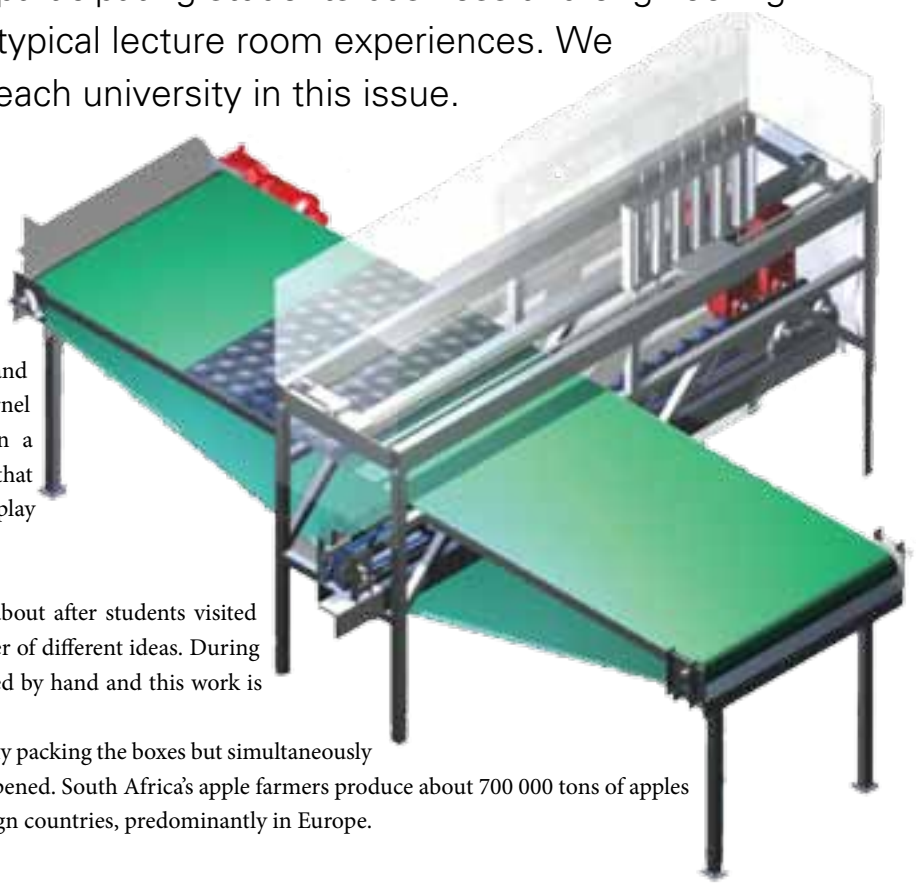
PNEUDRIVE Challenge picked their winners!

The aim of the PneuDrive Challenge is to give the best mechanical, electronic and mechatronic engineering students a chance to use their talent to bring together engineering theory, the latest technology in drive engineering and pneumatics and business reality. By creating a competition environment that requires proposing, designing and assembling innovative engineering ideas, students are given an opportunity to experience a wide range of problems and project issues that they would typically need to solve in the real world.

The practical experience of analysing, debating, designing and assembling an innovative engineering idea, gives participating students business and engineering experience that goes way beyond typical lecture room experiences. We showcase the 2011 winners from each university in this issue.

BY I PADDY HARDEGEN



SUNNYSIDE APPLE PACKER WINS TOP SPOT FOR STELLENBOSCH

The PneuDrive Challenge - organised and run by Festo and SEW Eurodrive annually - saw Norval Geldenhuys, Cornel Liebenberg, Daniel Malan and Hardus Scheepers, design a high-speed, accurate and selective apple-packing machine that not only packs the apples properly but also turns them to display the fruit when it's at its best.

The machine, dubbed the SunnySide Apple Packer came about after students visited various farms in the Western Cape and considered a number of different ideas. During the course of this research they found that apples are packed by hand and this work is tedious for worker.

The SunnySide Apple Packer set out to resolve this by not only packing the boxes but simultaneously rotating each apple to display its best side when the box is opened. South Africa's apple farmers produce about 700 000 tons of apples a year and they export roughly 42% of these to various foreign countries, predominantly in Europe.

All apples are currently packed by hand after they've been washed and graded. Specialised conveyors move individual apples along the packing line using rubber wheels and the apples are rotated as they go through a colour grader where grading cameras scan the surface of the apple and grade it accordingly.

There are fifteen weight classes and three grades but most of the apples weigh between 100 grams and 200g, with the heaviest class weighing in at 310g. The diameters of the apples range from between 90 mm to 50mm.

Conveyor belts moved the graded and weighed apples in the packing line to people who manually pack them into boxes. The boxes hold two trays of apples with 45 apples per tray, packed in a rhombohedral pattern. Each of the 90 apples in a box has an average mass of 144g and an average diameter of 72mm.

In designing the SunnySide Apple Packer, the team from Stellenbosch set down the following requirements and specifications:

- The machine had to be as efficient as hand packing where a maximum of 136 apples a minute are packed although the average is about 90 apples a minute. Manual packers take 61,5 seconds to pack a box but do not pack it with any consistency.
- The machine had to pack the apples in such a way that the natural colour of the apple based on its grading has best-looking cheek facing upwards.
- It had to pick up 99% of the apples passing through the machine and had to have a precision of less than one millimetre of vertical and horizontal actuation.
- It had to be no bigger than the existing manual packing lines and had to pack 45 apples in a rhombohedral pattern.
- It had to incorporate fail-safe mechanisms in case of an emergency and had to be hygienic, use non-toxic materials and must be easy to clean. No toxins should come into contact with the fruit.

Because of the existing infrastructure at the Two-a-Day packing-house, the students decided to design the packer over a singularity chain. A horizontal actuator moves parallel to the singularity chain with a vertical actuator attached to it. The apples are picked from the line and placed in the tray. The tray moves in perpendicular to the singularity chain and a camera is used to determine when the reddest side of the apple is facing upwards. It will then be picked up and packed in a single row and once one row is filled it will move to the next row until the trays are packed.

Six cylinders are used to pick the apples from the line because one tray has three places in a row and six cylinders deliver the best cycle time for the process as less time is spent travelling to and from the trays. Two trays can be placed next to each other and packed simultaneously.

Further analysis showed that, the SunnySide Apple Packer could pack an average of 190 apples per minute, considerably faster than even the best apple packers working in the packing-houses. The machine can display the best cheeks of all the apples and can run 24-hours a day without much supervision.

In finalising the design, the students found that the SunnySide Packer system has a total of ten axes: six DNCIs, the EGC, a conveyor axis, a flat belt and a singulator chain axis, which causes the apples to rotate on their carrier wheels.

A Programmable Logic Controller (PLC) controls the whole system. It needs to communicate with six pneumatic controllers, one linear actuator controller and three motor drivers.

The CPX-CMAX controller is used for the actuations of the DNCI cylinders and the PLC must use the same CPX topology. Students chose the CPX-CEC controller because it can control up to 31 axes but is most efficient when controlling the systems electrical drives via CAN-Bus. It uses SoftMotion technology to control the servo-motors CMMP-AS-C5-3A controller that actuates the EGC. It also has an Ethernet adapter to communicate with the personal computer, which in turn communicates with the camera.

To determine the exact colour of the apple, the Sunnyside Packer uses two cameras placed at a distance of 553 mm above the rotating apples giving it a viewing angle that will allow it to see 300mm of the singulator chain. The two cameras will cover 600mm, required to view for six apples.

The students chose a 12,7mm pitch lubricated steel roller chain to move the apples. The

Well-packed vs badly packed apples

100mm pitch Compac carrier wheels attach to the chain and a flat belt is used to control the carrier wheels, which rotate the apples.

To drive the belt and chain, the team used two SEW Movigears as these close-coupled, geared, servo-motors provide great efficiency, offer good speed control and are easy to install.

To pick the apples from the line, suction grippers are used and each picker needs four suction grippers to lift and shift the load. The size range of the two picker mechanisms allow the smaller mechanism to use 20mm suctions cups to pick up most of the apples as statistically the average apple weighs 145 g and has a diameter of 72mm.

In order to generate the vacuum needed for four suction grippers on each picker, the students chose a VADMI-95-P, which not only has the required suction but also provides the ejector pulse that sets down the apples quickly and gently.

For horizontal movement the EGC was chosen as it delivers precise, controllable movements and ensures reliable placement for the picking and placing processes.

The conveyor moves the trays in increments of

PNEUDRIVE Challenge picked their winners!

continues from page 47

45 mm using a geared, SEW AC servo-motor while a MoviDrive-B is used to move the belt in specific positional increments. The initial position of the belt is when the first row of the tray is in a position to be packed. After the row is filled, it will move 45mm for the next empty row to be in the correct position and this will continue until all 16 rows have been packed. The rows are 45 mm apart and the increments are therefore identical.

The system is mounted on a steel frame that is bolted to the floor. Regular maintenance of the SunnySide Packer is required and a full visual inspection of the system must be done every six months.

The entire system costs R800 000 to build and install.

The design impressed the judges who awarded First Prize to the four Stellenbosch students who received an all-expenses-paid, 10-day trip to Germany. The university receives R100 000 worth of products from SEW Eurodrive and Festo while each participant is entitled to R40 000 worth of products for completing the competition.

AUTOMATED MEAL AND DRINKS SERVICE ON PLANES

Thousands of passengers flying on scheduled domestic airlines may have experienced the frustration of waiting for meals, soft drinks, tea, coffee or any alcoholic beverage on flights between the main centres.

It's not surprising, because the system used by airlines is hopelessly outdated –that's what students at the Tshwane University of Technology (TUT) found when they were brainstorming ideas for the 2011 PneuDrive Challenge organised by SEW Eurodrive and Festo.

The students, Izak Nel, Alfred Barnard, Coenraad Prinsloo and Christiaan Oosthuizen, came up with an idea to design and build an automated drinks and meals dispenser for airlines and the Air-Bot was born. In researching their idea the students found that most of the airlines flying domestically in South Africa serve food and beverages to passengers either at no cost or on a cash-sale basis. During the course of their research they also found that no other airline had implemented any automatic or semi-automatic systems to assist cabin crews to dispense meals or drinks.

The students came up with a solution that is relatively simple: mechanical assistance to move the trolleys, electronic stock control and manual distribution of the meal or drinks. It works on the basis of a mechanised trolley that moves autonomously down the centre aisle of the aircraft dispensing meals or drinks ordered through a graphic user interface touchscreen. The records of orders received and meals or drinks dispensed are kept and checked against the sales data for post-flight stock-cash balancing.

The items inside the trolley are housed in access ports that can only be accessed once a direct and authorised instruction to provide the specific product has been received from a programmable logic controller (PLC) based on the software control system. Every event is logged and documented. This gives the airline operators an accurate and precise record of the meals and beverages sold on every flight, thus reducing stock losses and increasing the efficiency of the cabin crew.

The Air-Bot semi-autonomous food and beverage distribution system comprises:

- Electrical distribution using the Movitrans electromagnetic induction system and its associated parts. This provides the electrical power to the Air-Bot for the PLC and the drive systems and it allows mobility, adds little weight to the trolley, takes up minimal space and is quiet so as not to disturb the passengers.

- Mechanisation of the Air-Bot's internal drive system is achieved through the motors that allow it to move automatically on tracks. There is no wiring from a mains power source and there are no exposed high-voltage connections because power transfer is done through electro-magnetic induction
- Distribution of the meals or beverages using the Air-Bot's dispensing system means that each meal can be correctly served and accounted for.

For the food and beverage dispensing system it was necessary to have as many installed 'dispensing magazines' as possible to provide a greater variety of drinks and meals for passengers. The distribution system uses very thin (18,5 mm) SLG actuators that can generate 68 Newtons of force.

The drinks and meals are contained in magazine-type containers, similar to a cartridge feeding mechanism of pistol's ammunition magazine. It is a purely pneumatic system that interfaces with the Festo CPX PLC, with integrated valve slots on the PLC minimising space requirements below the actuator for valves.

The students point out in their submission that the Air-Bot is "light years ahead" in terms of its design and functionality because:

- It is the first system that incorporates actuators to dispense food, moves under its

own power and provides on-board stock controls that record what has been sold;

- It uses a Movitrans drive system and this means it does not need heavy batteries and cables.
- It's steering system makes it extremely versatile and its 'magazine feed system' can be stocked automatically or manually. Stocks can easily and quickly be replenished.
- Precise controls from the PLC mean that it will dispense only those products ordered by a passenger on board. Because the magazines are modular and interchangeable they can be adapted to serve only food, only drinks or a combination of both.
- A 'dead-man' switch means that the Air-Bot is safe in case of any malfunction. The majority of food and canned drinks are dispensed from the top of the Air-Bot while the small bottles containing alcoholic beverages are dispensed from the side.

The trolley itself is 910mm long and 500mm wide and this is sufficient to provide a dispensing system for sandwiches, soft drinks, beverages and alcohol from a single trolley. The height of the trolley is 1 100mm to allow for a comfortable human interface while incorporating the necessary space for the motors and drive train systems.

Two thermal flasks at the front of the trolley are used to dispense tea and coffee or any other hot drinks that need to be mixed. It has a capacity for 30 servings per flask. The cup dispenser is spring-loaded and holds up to 60 cups. It also contains an ice bucket that must be filled by the cabin crew.

The magazine-type dispensing system uses a rodless linear actuator mounted on the side of the container. It has a load capacity of up to 5kg and is double-acting for lifting and lowering, with a stroke range of about 800mm.

The magazine bodies are made from form-bent 2mm-thick steel plate with 1mm tolerances on all sides of the product. The lifting attachment is made from plastic sheet 5mm thick with a 1,5mm clearance of the lifter-magazine borders.

For mobility the Air-Bot uses the Movitrans to provide contactless energy to the motors and to control the PLC systems. A TPS converter is used to convert incoming low-frequency alternating voltage (50/60Hz) into alternating voltage with a constant frequency of 25 kHz. The transformer module is a 4KW system that uses a 60 Amp line from the supply cable. The THM pick-ups use a contactless transfer of energy from the line cable to the TPM mobile converter through a flat pick-up that is 15mm thick and is installed in the floor for minimal loss of energy.

The Air-Bot, has two motors at 120W each and moves at two-metres-a-second. There is sufficient additional power to move the Air-Bot rapidly if it needs to be stored in case of emergencies.
The steering system uses two independent wheels to receive power from different motors and for forward motion the two motors work at exactly the same number of revolutions. This is reversed for

PNEUDRIVE Challenge picked their winners!

continues from page 49

backward motion. When the trolley needs to turn, one wheel's speed is reduced so that the wheels run at different velocities allowing for tight turns that allow the wheels to turn in a circle without the trolley moving.
It uses Brecoflex belt drives and pulleys between the wheels and motors with two bearings per shaft.

The alcohol-bottle-dispensing system allows for four different types of bottle dispensed by a piston mounted on a rodless linear drive that pushes the bottle to the collection area. The four units are mounted next to each other and each one can hold 17 bottles.

The air consumption needed for dispensing food or drinks uses a five-litre thin pressure vessel at a constant pressure of six bar with air supplied from a 35-litre reservoir, needed to maintain that pressure. The air vessel is charged with air at between 10- and 14-bar gauge pressure.
The Air-Bot's PLC system has 15 analogue inputs and two analogue outputs as well as eight digital inputs and a further eight digital outputs. The Air-Bot PLC system controls an input valve for the air supply, 16 three-way valves and one two-way double solenoid valves. It is also connected to the graphical user interface so passengers can place orders.

According to estimates done by the TUT students, the cost of the Air-Bot (including installation) is about R667 000. The project was considered by the judges to be sufficiently enterprising to earn the students Second Prize in the 2011 PneuDrive Challenge.

COME DINE WITH ME – IN A FULLY AUTOMATED RESTAURANT

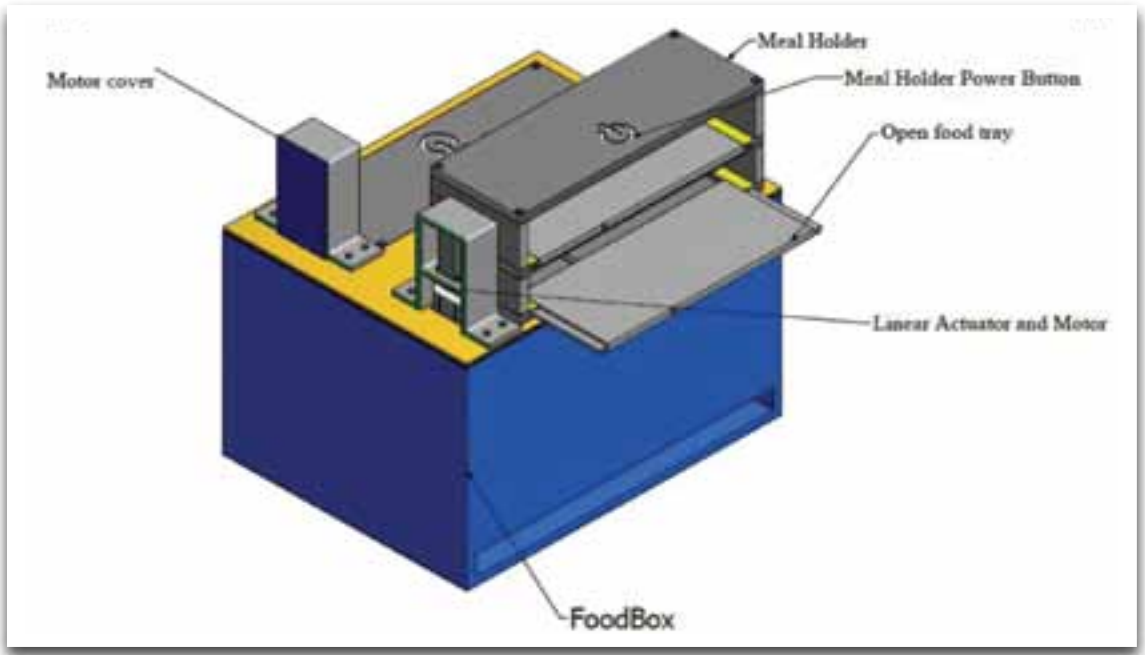
A team of students from the University of Witwatersrand have come up with a design for an automated restaurant as their entry for the 2011 PneuDrive Challenge and this design is no mean feat.

The team of students, Mduduzi Masuku, Lefa Madire, Meshi Hamese and David Ndeveelo, designed a system that allows for plated food to be delivered directly from the kitchen to diners seated at any one of the tables in the restaurant.
The design uses mechanical, electrical, computer and mechatronics components to create an automated restaurant and was based, in part on existing automated restaurants found in South Africa and elsewhere in the world.

Students analysed the system developed by Yoshiaki Shiraishi where a conveyor belt is used to provide sushi to diners seated around a large table. They also studied the fully automated restaurant developed by Michael Mack in Nuremburg where chefs in a kitchen on the upper level receive orders via a touchscreen computer, prepare the meal (once paid for) and deliver it down a spiral metallic rail in a specially designed cart that slows to a stop at the table.

The Wits team did some market research among a cross section of people in restaurants and found that diners wanted their food to be plated in the kitchen but did not mind helping themselves to the meal, the drinks or the condiments that accompany it once it arrived at the table.

In summary, once the food has been prepared in the kitchen, it is placed in a Food-Box by the kitchen staff. A button is pressed to signal which table the Food-Box must be delivered to.



The Food-Box is lowered onto a lowering mechanism and taken to the basement where a robot is used to unload the Food-Box from the lifting mechanism onto the cart. The cart moves to the correct table and, once there, a lifting mechanism lifts its towards the table.

This movement triggers an inductive proximity sensor as the Food-Box is lifted, which

in turn triggers a signal that opens sliders in the table. The Food-Box is lifted to the correct position, opens up allowing trays to slide outwards presenting the plated food, drinks and condiments to the diner.

Once the meal has been eaten, the plates, empty glasses, cutlery and condiments are placed back in the Food-Box and a 'finished' button is pressed. This reverses the process and takes the Food-Box back to the kitchen.

The mechanical components needed to deliver meals to the table in the Automated Restaurant are not visible to diners until the full meal is delivered and the Food-Box automatically opens.

The lifting mechanism used to lower and lift the Food-Box from the kitchen to the basement uses a power screw driven by a motor that lowers the food to a cart on the conveyor mechanism. The cart is on rails underneath the dining area.

A translator robot uses a forklift mechanism to lift the tray from the cart that holds the Food-Box and places it on a second lifting mechanism underneath the correct table. One translator robot is used to move the Food-Box to any one of three tables in a row above it.

The translator robot moves forwards and backwards to lift the food carrier 150 mm onto the lifting mechanism. It has two rails and uses two double-acting pneumatic cylinders, one to push the slider back and forth and the other to pull the Food-Box up or down. The forks must slide at different rates when folding and this is achieved by altering the gear ratios.

Once at the correct table a pulley mechanism fitted underneath the table is used to lift the Food-Box into position. As it is being lifted, a sensor triggers a sliding mechanism that allows sliding panels in the centre of the table to gradually move apart so that the Food-Box reaches its final position where it automatically opens. The pulley system uses a winch with a tensioned 4 mm galvanised wire rope wound around a rotating drum with a diameter equivalent to at least 30 times that of the rope. The winch shaft was designed to be coupled to a SEW geared motor matched to the drive gears, electronics and controls.

The sliding mechanism in the table uses a Festo linear actuator that converts rotational motion into linear motion and is achieved using a power screw connection. The advantage of this linear actuator is that it can be used with both servo and stepper motors and has a working range of more than 300 mm.

On one side the slider assembly is connected to the moving part of the linear actuator. This arrangement does not interfere with the motor when one edge of the slider moves to the side where the motor is attached. On the other side, a roller is attached to support the slider and prevent the whole weight of the slider being imposed onto the actuator and stops any bending movement in the transverse direction. The slider (and table) is made from oak.

The Food-Box contains two meal-holders that open on opposites sides and slide outwards to serve the meals simultaneously on both sides of the table. Each meal-holder has two trays on different levels with one level carrying the plated food and condiments and the second carrying the drinks and cutlery. Each Food-Box carries a complete meal, as ordered.

The Food-Box weighs 50 kg without food and this increases to 60 kg once the food, cutlery, drinks and condiments are added. It comprises the linear actuator motor, the meal-holder and the food trays. The mass of the meal-holder is 6,368 kg and with food is 11,368 kg.

A computer controls the Automated Restaurant thus integrating electrical engineering elements with computer technology and mechanical engineering. This provided the students with an inter-disciplinary understanding necessary for any mechatronics project.

In analysing the energy efficiency of the design the students determined:

- Ten SEW Movigear motors were required to move the cart on the rail mechanisms, consuming 21,25 W;
- The pulley mechanism to lift the Food-Box to the table is 325,7 W;
- The translating robot consumed 17,625 W while its slider consumed a further 525 W.
- The standby power consumption for the sub-systems is estimated at 18 W/h.

The cost of the Automated Restaurant is estimated at R298 561,26 (excluding VAT). It won Third Place in the 2011 PneuDrive Challenge. wn

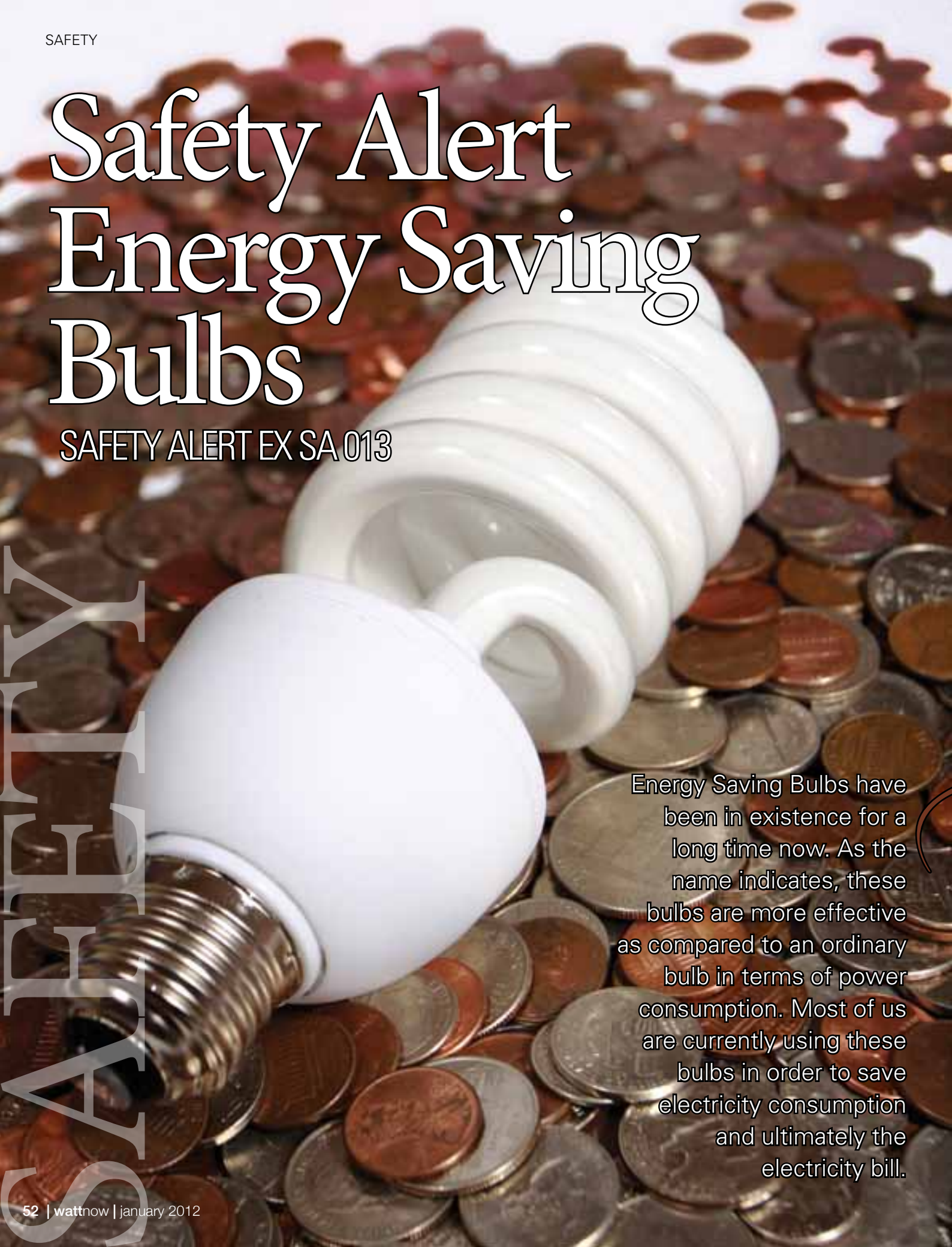
After four successful years of running the competition, SEW Eurodrive and FESTO have once again committed to sponsoring the PneuDrive Challenge engineering student competition in 2012.

Rules and guidelines for the 2012 competition have been reviewed and updated, and are available on the website.

Visit www.pneudrive.co.za

Safety Alert Energy Saving Bulbs

SAFETY ALERT EX SA 013



Energy Saving Bulbs have been in existence for a long time now. As the name indicates, these bulbs are more effective as compared to an ordinary bulb in terms of power consumption. Most of us are currently using these bulbs in order to save electricity consumption and ultimately the electricity bill.

On the 10th February 2011 an energy saver bulb fused at the home of this patient. Unfortunately, he didn't wait for it to cool down and whilst standing on a chair with a piece of cloth to remove the energy saver bulb, he dropped it. When the bulb fell on the floor it "exploded" and when this man climbed off the chair, he stepped onto the broken glass and was exposed to mercury powder. He was admitted to hospital for treatment of the cuts and has spent two weeks in ICU. It was feared that his foot might be amputated. Currently his foot is connected to a vacuum pump to remove continuously dead tissue. A long road of recovery is awaiting him.

Vacuum Pump Connected to remove dead tissue from the foot.

Energy Saving Bulbs will come indifferent shapes on the market with different ratings in terms of Voltage or Watts and they will definitely save our pockets especially when we are buying electricity in our respective houses.

However, these types of bulbs, if broken cause serious danger.

• If one breaks, everybody will have to leave te room for at least 15 minutes, because it contains Mercury (poisonous) which causes migraine, disorientation, imbalances and different other health problems, when inhaled.

• It causes may people with allergies, severe skin conditions and other diseases just by touching this substance or inhaling it.

• Do NOT clean the debris of the broken bulb with a vacuum cleaner, because it would spread the contamination to other rooms in the house when using the vacuum cleaner again. It must be cleaned up with a normal broom or brush, be kept in a sealed bag and disposed of right away from the house in a bin for hazardous materials.

Herewith precautions if a low energy light bulb breaks

- Evacuate the room, taking care not to step on the shards of glass littering the floor.
- Do not use a vacuum cleaner to clear up the mess as the machines sucking action could spread toxic mercury droplets around the house.
- Put on rubber gloves and sweep the debris onto the dustpan.
- Place the remains in a lactic bag and seal it.
- Do not put the plastic in a normal household bin.
- Instead, place it in a municipal recycling bin for batteries which also contain mercury or take it to a council dump where it can be disposed of safely. As LMC Residents, we can make use of separate Black Refuse Plastic Bags, but do not put it in a normal household bin.
- Try not to inhales dust from the broken bulb. wn

The Engineering Profession Act, No 46 of 2000 prescribes the requirement that all registered professionals have to undergo Continuing Professional Development (CPD) throughout their active careers. In 2006 the Council of ECSA introduced CPD as one of the requirements for the five yearly renewals of all professional registrations.

CONTINUING PROFESSIONAL DEVELOPMENT OF (REGISTERED) ENGINEERING PRACTITIONERS

BY I DU TOIT GROBLER **I** INTPI(SA)(EE), PRING(EE), PRDIPLING(EE)
CENTENARY PRESIDENT 2009: SAIEE

Compliance with the requirements of the ECSA Policy on CPD and the regular renewal of registration is binding on all professionals.

The ECSA Policy on CPD took effect on 1 January 2007 and the first renewal cycle will end on 31 December 2011. Since 2007 every professional has had to submit in the prescribed form annually on the anniversary date of his/her registration a return of the CPD which he/she has undergone during the previous 12 months. On the five yearly anniversary of registration, application has to be made for the renewal of professional registration. There is no fee payable when applying to renew your registration.

The first CPD cycle provided for the phasing in of renewal of registration resulting in professionals having had to apply for renewal after a period of less than 5 years since the introduction of CPD. During the second renewal cycle commencing on 1 January 2012 and thereafter during all subsequent cycles, renewal will take place on completion of five years. All registered persons will accordingly be required to present 25 CPD credits to renew their registration as from January 2012.

Individuals who are registered in more than one professional category only have to submit one annual CPD return and one application for the five yearly renewal of registration. Such individuals have the option to choose which registration date will apply for the purpose of the return and the application for renewal.

Professionals have to earn 5 CPD credits per year (i.e. 25 per renewal cycle), or at least three credits per annum in two categories provided they obtain the full 25 credits in the five year cycle with the proviso that in category one, one activity per annum is compulsory. The three categories are:

- Developmental Activities:
  Active attendance of validated Engineering Events - one credit per day, one credit **minimum**
- Work based Activities which has two sub-categories, i.e.
  a. Practicing professional engineering - one credit for every 400 hours worked, maximum 2 credits per year
  b. Professional mentoring of Candidates – minimum 50 hours per year, maximum 1 credit
- Individual Activities which has two sub-categories, i.e.
  a. Membership of an ECSA recognised Voluntary Association – maximum one credit
  b. Engineering activities such as further studies, teaching, participation in standards development, etc.

CPD credits can be carried over from one year to another within the same cycle, but not from one cycle to the next.

ESCA delegated the validation of CPD events to Voluntary Associations such as the SA Institute of Electrical Engineers and to tertiary academic institutions with accredited Schools of Engineering.

Validation in the case of the SAIEE is carried out under the auspices of the Professional Development Committee of Council and is based on the assessment of material to be presented during the event, the assessment of the competence of the event presenter/s and observation of the event.

Sue Moseley is responsible for the administration of CPD in the SAIEE. Events are validated for a maximum period of three years and are subject to re-validation should the event organizer change the contents substantially. Every validated event is given a validation number and the maximum number of CPD credits which can be earned. Validated events are listed on the SAIEE and ECSA websites.

Professionals who attend unvalidated overseas events have to apply at the end of the event to ECSA for approval of attendance of such an event and to allocate CPD credits on an exception basis. Full technical details of the event as well as the credentials of the presenter/s must be submitted in order to conduct such an evaluation.

Compliance with the requirements of the ECSA Policy on CPD and the regular renewal of registration is binding on all professionals. Defaulters risk the cancellation of their professional registration.

The submission of returns and applications for renewal of registration took off rather slowly, however according to Johan Pienaar, Manager Registration at ECSA, 75% of professionals are renewing their registration.

During the first cycle ECSA awarded complementary credits in category one in view of the phasing in of the validation of events. Now there is a large data base of validated events which professionals can elect to attend.

Also, a decision has been taken as an interim measure not to cancel any registrations of defaulters but to keep on encouraging all professional to comply with requirements and to continue to take part in the process. It is foreseen that this arrangement will apply until the Identification of Engineering Work which is also provided for in the Engineering Profession Act, has been implemented.

ECSA has established a CPD Department which can be contacted for all queries regarding the earning of credits, the annual returns and submission of applications for renewal of registrations.
Telephone number 011 607 9500 or by e-mail: engineer@ecsa.co.za.

An appeal is made to all professionals to take part in the requirements of the Act and also to make themselves available to assist fellow professionals to continue to develop their competencies as professionals and to remain registered with ECSA. wn

SAIEE CPD Courses

Electric Power Cable Tutorial

On Thursday 10 November 2011 the SAIEE held an Electric Power Cable Tutorial Course at the S.A. Museum of Military History in Saxonwold, Johannesburg that was presented by Aberdare Cables' expert course director, Dick Hardie PrEng FSAIEE.

The course explained the techniques used in the correct selection of electric cables. Understand use of de-rating factors, applicable to particular conditions of installation. Find out how to calculate a cable's ability to survive fault current, volt-drop, fire performance, and a whole lot of other relevant and essential information.

This tutorial benefited those responsible for the selection, buying, handling and installation of electric cables up to 33kV, as well as those involved in the design of electric cable networks up to 33kV.

There were 21 delegates that attended the course, the presentation was very well received by all attendee's who received 1 CPD credit for attending the event.

Business Continuity Management

On Wednesday & Thursday 16-17 November 2011 the SAIEE held a Business Continuity Management course at the Corporate Conference Centre in Dowerglen, Edenvale that was presented by Mark Penberthy, a Fellow of the UK-based Business Continuity Institute. Mark has 12 years experience in the Business Continuity industry, both as a consultant and trainer. He has trained over 1200 delegates throughout Africa over the past 5 years, and is an accomplished public speaker on the subject.

The object of this course is to allow an organisation to proactively identify the requirements to protect its people, premises, technology, information, supply chain, stakeholders and reputation against disruptions from fire, flood, power failure, telecoms

outages, staff casualties, computer viruses and hardware or software failure.

The course benefited Senior Executives, Board Members and Proprietors of the SME's who have either a direct interest, or are accountable for ensuring that their organisation can withstand a significant operational disruption.

There were 22 delegates that attended the course, the presentation was very well received by all attendee's who received 2 CPD credits for attending the event.

Electromagnetism Transformers Course

On the 23rd and 24th of November 2011 the SAIEE held an Electromagnetism Transformers Course at the S.A Museum of Military History in Saxonwold, Johannesburg that was presented by Viv Cohen who is a renowned expert in his field and a fellow of the Institute he is also a representative on several committees of the SABS.

This course benefited everyone involved in or interested in electromagnetism and transformers. The course outline consisted of Electric & Magnetic Fields, The B-H Loop, Maxwell's Equations, Transformers Cores and Coils, Transformer Design Specifications & Testing, and EMC.

The course was very well received by all 18 attendees, who received 2 CPD credits. wn

CPD COURSE NOTICE : 2012

For more information or to book your pace, contact BRENDON VILJOEN
T 011 487 9042 |E brendonv@saiee.org.za

REPORT WRITING FOR ENGINEERS

A course for those in the technical environment needing to effectively communicate in writing and thus develop their relationships with colleagues and customers.

WHERE JOHANNESBURG
DATES 15 - 16 February 2012
COST R3,850 (incl. VAT) - 20% discount for active SAIEE members
CPD CREDITS 2

LV VARIABLE FREQUENCY CONTROLS

This course is concerned with the technology of applying variable frequency control to a variety of low voltage (to 690V) industrial applications. It is an in-depth course, starting with basic mechanics for drives, the AC cage motor and then the various levels of controller technology to satisfy simple to complex drive applications. It is intended for those with a serious interest in marketing, applying and maintaining frequency drive systems

WHERE JOHANNESBURG
DATE 22 - 23 February 2012
COST R3,850 (incl. VAT) - 20% discount for SAIEE members
SAIEE-0561-V: 2 CPD CREDITS

PHOTOVOLTAIC SOLAR SYSTEMS

This course will provide the knowledge on how to inspect a site for the installation of a PV Solar System, provide the basic knowledge for installation, do necessary calculations for the correct applications, analyse different configurations and operating characteristics, provide the rules and regulations with regard to compliance of statutory requirements, and safety procedures and codes of practice.

WHERE JOHANNESBURG
DATE 7 - 8 March 2012
COST R3,850 (incl. VAT) - 20% discount for SAIEE members
CPD CREDITS 2

This course will provide the knowledge on how to inspect a site for the installation of a PV Solar System, provide the basic knowledge for installation, do necessary calculations for the correct applications, analyse different configurations and operating characteristics, provide the rules and regulations with regard to compliance of statutory requirements, and safety procedures and codes of practice.

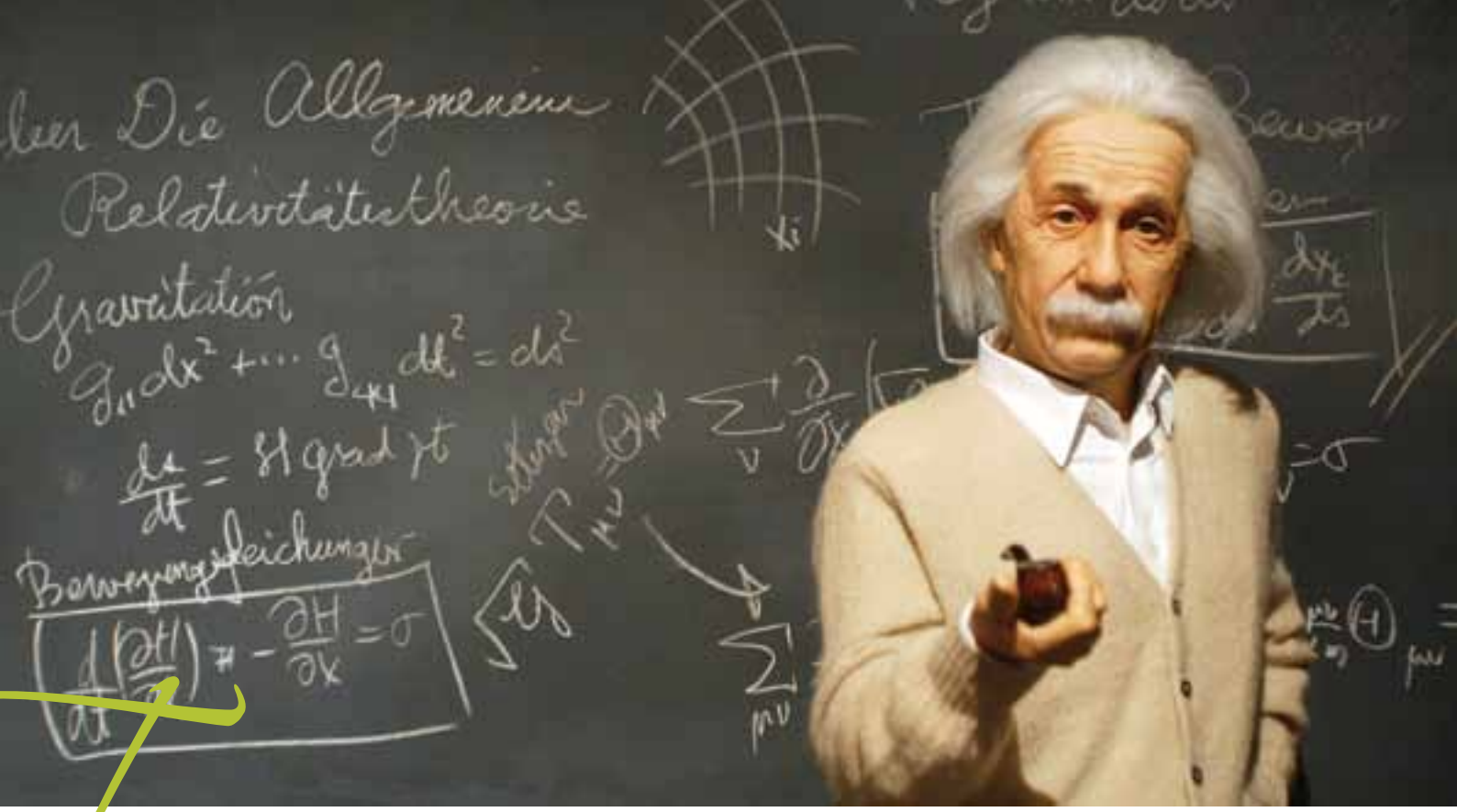
FINANCE ESSENTIALS FOR ENGINEERS

Budgeting Fundamentals: Benefits & Methods/ Managing a Budget: Preparation & Control/ Exploring the Ground Rules of Finance: Who needs Finance ? Tract Revenue and Expenses/ Using Financial Statements : The Income Statement, The Balance Sheet, The Cash Flow Statement/ Evaluating Performance: Make Comparison, Determine Liquidity, Activity, Profitability and Solvency / Making Investment Decisions: The Investment Decision-Making Process, Conduct a CVP Analysis, Project Appraisal Techniques, Market Demand Calculation Details, Table of Discount Factors, Activity Worksheets

WHERE JOHANNESBURG
DATE 28-29 March 2012
COST R3,850 (incl. VAT) - 20% discount for active SAIEE members
CPD CREDITS 2

Mentorship

The offer comes at a time when our country is suffering a shortage of skills, and we believe that mentoring is an essential requirement in the training and development of the next generation of engineers. If, as a member of the SAIEE, you believe that you need a mentor you can request a mentorship service from the Institute.



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

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

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

The mentee will be able to discuss problems and frustrations with his independent mentor, who would have no stake in the outcome, and who would be able to provide an unbiased opinion and advice. The mentee might not be able to do so with his superiors, particularly if he is unhappy, and is considering an alternative career. The mentor and mentee could arrange to meet regularly, on terms that would suit both parties. The goal is to ensure both Mentee and Mentor have enough time to communicate any concerns or advice they have.

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

Among its more than 5500 members the SAIEE has many experienced engineers who are willing to act as mentors. They are spread across the country and include engineers who are experienced in steelworks, furnaces, rolling mills, mining, manufacturing, electrical generation, transmission and distribution, through to light industrial, process control, instrumentation, telecommunication, robotics, automation, software development and engineering management of these sectors.

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

Prospective SAIEE Mentors

If you feel you that you have the time and interest to help mentees, please contact Brendon Viljoen on 011 487 9042 or brendonv@saiee.org.za. In addition you gain CPD credits for when you are required to re-register. wn

SAIEE Membership
What's In It For Me?

Members of the SAIEE now enjoy a wide array of benefits starting at a R950 discount on their ECSA registration fee which is due in April every year, provided you join the SAIEE before the end of March of the same year.

Upon joining the SAIEE there is a standard entrance fee of R650 and an annual membership fee of R756.00 for members, and between R924.00 and R1002.00 for senior members depending on age. Most of this will be recovered through the ECSA discount.

SAIEE members receive 11 free issues of the WattNow magazine valued at R330 along with the quarterly African Research Journal - our local research and development magazine.

However, the real rewards of being a SAIEE Member can be realized through attending our monthly lectures, debates, tours and site visits, which are mostly free and accompanied with refreshments at no extra cost. Members are awarded valuable CPD credits for attending these events & functions.

Being a member has significant career benefits, as membership holds prestige and recognized status in the profession. SAIEE gatherings provide excellent opportunities for its members to interact with normally inaccessable senior leaders in the industry. Letters after your name indicate your membership grade and are a useful measure of experience.

Members receive generous discounts on the SAIEE run CPD courses and earn (category 1) CPD credits. Members also have the option of joining the WattNow online CPD program at a fraction of the cost. The SAIEE mentorship program assists members in gaining professional status through the Institutes large database of mentors. SAIEE members are awarded 1 CPD credit (Category3) for being a member.

Members are able to serve on organizing committees and gain valuable experience in doing so, while learning how to run formal meetings and practice technical presentations in a low risk environment.

APPLICATION REQUIREMENTS FOR SAIEE MEMBERSHIP

It is always exciting to receive an application as it means that we will soon be welcoming another new and valuable SAIEE member to our family of nearly 6000 members. However, more often than not the application is incomplete.

To avoid unnecessary delays in the process it is important to highlight the problems regularly experienced within the administration with received applications:-
Many applicants do not read the list of requirements. We require the following documents:

- Copy of the applicants ***ID***;
- Certified copies of ***achievement certificates***;
- A copy of the applicants ***CV***;
- The completed ***application form***;
- ***Proof of payment*** for the application fee. Membership fee will be comfirmed on acceptance of membership.

Copies of the above listed documentation should ***accompany the application forms*** but frequently are submitted after the application forms are sent in.

A number of applicants do not fill in every answer to questions asked on the application forms, ***please complete the form in full.***

Payment of both application fees and membership fees are frequently ***not paid timeously.***

Only once all the above requirements have been met is the application considered complete, enabling the process to continue efficiently.

Please, help us to help you receive the many benefits of SAIEE Membership sooner rather than later!!

Membership Fees

Effective January 2012

Council at its meeting held on 02 September 2011 decided that subscription and entrance fees as from 01 January for 2012 should be as indicated below. Please note: In terms of Bylaw 3.2 annual subscriptions shall become due on 1st January each year. To encourage members to pay their subscription fee early, Council agreed to allow a discount if such fees are paid before 31 March 2012.

Grade of Membership	Annual Subscriptions paid before 31 March 2012		Annual Subscriptions paid after 31 March 2012		New Members FEES * see Notes 1 & 4 below.	
	RSA incl VAT (R)	Outside RSA excl VAT (R)	RSA incl VAT (R)	Outside RSA excl VAT (R)	RSA incl VAT (R)	Outside RSA excl VAT (R)
Student	106	75	118	84	118	84
After 6 yrs study	684	486	760	540	760	540
Associate	684	486	760	540	760	540
Member	756	537	840	596	840	596
after 6 years	884	627	982	697	n/a	n/a
after 10 years	924	656	1,027	729	n/a	n/a
Senior Member	924	656	1,027	729	1,027	729
after 6yrs/age 40	1,002	711	1,113	790	1,113	790
Fellow	1,002	711	1,113	790	1,113	790
Retired Member (By-law B3.7.1)	423	300	470	334	n/a	n/a
Retired Member (By-law B3.7.3)	nil	nil	nil	nil	n/a	n/a

NOTE

1. Entrance fee for all grades of membership is R650 (except Students which is free)
2. Transfer fee to a higher grade is R300.00 for all grades of membership (except Student within 3 months of qualifying).
3. Members are encouraged to transfer to a higher grade when they qualify. It will be noted that the fees of Member and Senior Member grades after 10 and 6 years respectively are equal to the fees at the next higher grade.
4. Members elected after June pay a reduced subscription fee.

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

By-law B3.7.3 reads "any member complying with the conditions of B3.7.1 but who has been a member of the Institute for not less than 25 consecutive years, shall on written application to Council, be exempt from the payment of further subscriptions."

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

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

18A Gill Street | Observatory |T 011 487 3003 |F 011 487 3002
www.saiee.org.za

CALENDAR

2012

Calendar of events

If you want to see your function or event listed here, please send the details to Gerda Geyer at geyerg@saiee.org.za

February 2012

3	Council Meeting	SAIEE House	
6-9	Investing in African Mining Indaba	Intl Convention Centre, Cape Town	www.miningindaba.com
21-23	Africa Energy Indaba 2012	Sandton Convention Centre, Johannesburg	www.energyindaba.co.za/
28 - 2	Africa Roads 2012	Sandton Convention Centre, Johannesburg	www.terrapinn.com/2012/africaroads/
t.b.c.	SAIEE Golf Day	Benoni Lake Golf Club	

March 2012

2	Council Meeting	SAIEE House	
12-16	Certified Energy Manager Course	Emperor's Palace, Gauteng	www.energytrainingfoundation.co.za
26-29	Power & Electricity World Africa Expo	Sandton Convention Centre, Johannesburg	
29	SAIEE AGM	SAIEE House	

win R1000

Have some fun and stand a chance to win R1000. Complete the Energy issue crossword puzzle and send it with your name, surname and contact details to: *Managing Editor, Energy Crossword Puzzle, P.O. Box 751253, Gardenview, 2047* or email it to *wattnow@saiee.org.za.* The completed crossword puzzle should reach us by no later than **28 February 2012**. The winner of R1000 will be announced in the April issue of the **watt**now magazine.

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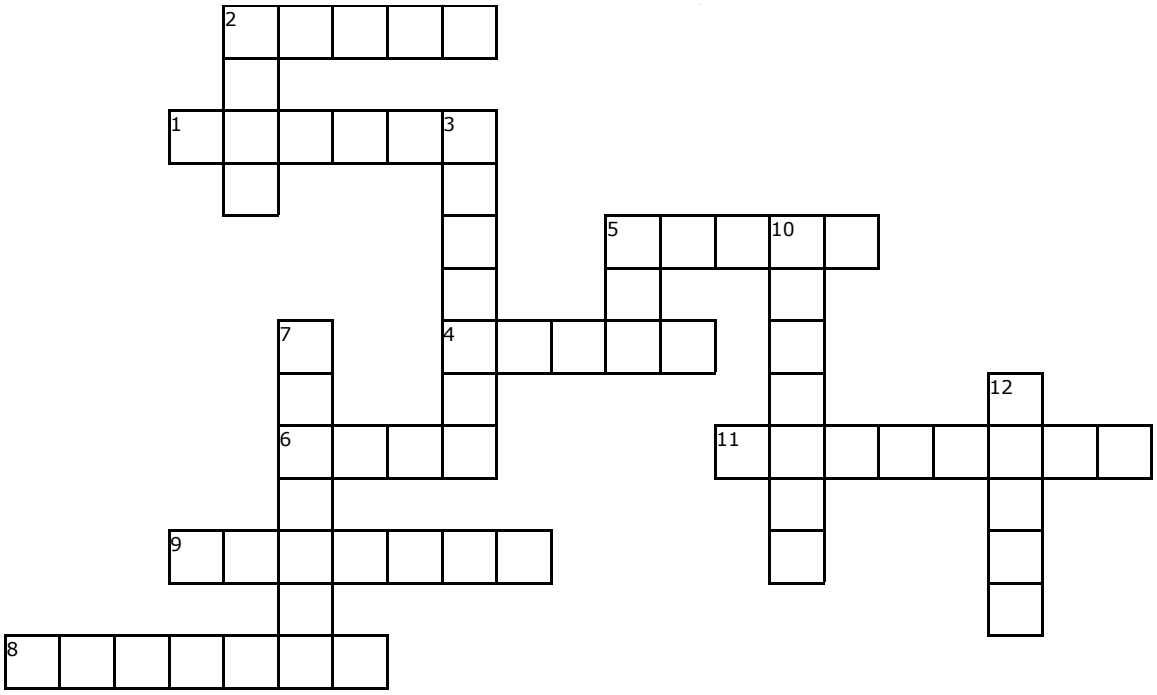

ACROSS

1. The country with the largest coal fired power station in the world
2. The 17th meeting of the parties
4. Entity that consumes 46% of South African annual coal production
5. Number of tons of CO^2, rounded up, produced by burning 1 ton of coal.
6. Burning coal produces 7 over (?) times more CO^2 than burning methane
8. This gas is more than 20 times more effective in trapping heat than CO^2.
9. Multi-junction Solar Cells have an efficiency (?) than 30%
11. Estimated shale gas reserves in the Karoo are 450 (?) cubic feet

DOWN

2. South Africa produces more than 90% of its electrical energy from this source
3. The highest capacity factor energy source
5. % of South African water usage used to produce electricity
7. Dry cooling at power stations uses (?) times less water than conventional cooling.
10. What is the type of fermentation that takes place in the digestive systems of anaimals and results in the 2nd greatest source of human related activity GHG emissions?
12. Record wind farm capacity factor in % to the nearest 10% as at April 2011

Terms and conditions: 1. Only one entry per person. 2. Winners will be notified via email. 3. Incorrect information will automatically disqualify the entrant. 4. Anybody may take part except the office staff of the SAIEE, their family members and members of the Publications Committee. 5. **watt**now magazine and the SAIEE cannot take any responsibility for lost entry forms or any damage, losses or injuries related to the draw of the prize. 6. The winner must be prepared to be photographed and such photograph will be published in the relevant issue of the **watt**now magazine. 7. Closing date for entry is 28 February 2012. 8. The winner will be announced in the April issue of the **watt**now magazine. 9. The Managing Editor's decision is final and no correspondence will be entered into.

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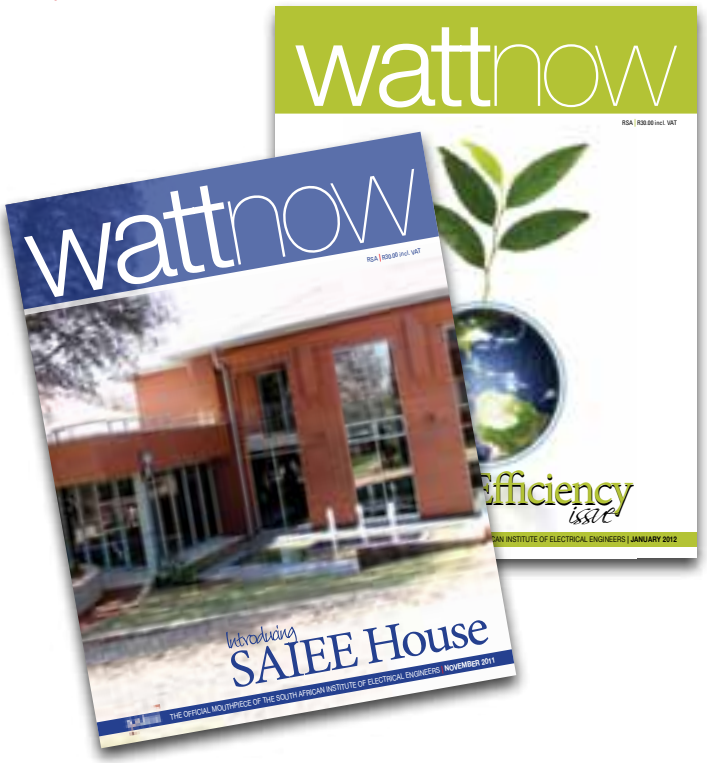

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If you are not a SAIEE member, but would like to receive your own copy of the **watt**now magazine, then subscribe today.

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SAIEE

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